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No. 1784

HANDBOOK OF THE
4.7-INCH GUN MATÉRIEL
MODEL OF 1906
MOTORIZED
WITH INSTRUCTIONS FOR ITS CARE

TWENTY-FOUR PLATES

MARCH 25, 1918



WASHINGTON
GOVERNMENT PRINTING OFFICE
1918



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U.S. Ordnance Dept.

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WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, March 25, 1918.

This manual is published for the information and government of
the Army of the United States.

By order of the Secretary of War:

CHAS. B. WHEELER,
*Brigadier General, Ordnance, National Army,
Acting Chief of Ordnance.*

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JUL 24 1918

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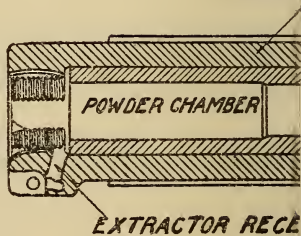
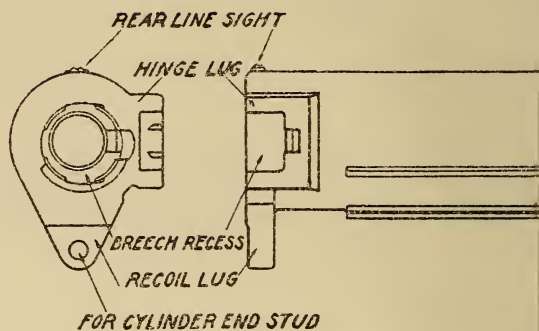
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¹ Six caissons model of 1908 may be substituted for 6 caissons model of 1917 or 1916, 6 caisson limbers model of 1908 may be substituted for 6 caissons. A description of the caisson and caisson limber model of 1908 is in handbook No. 1771, revised September 15, 1917.



HANDBOOK OF THE 4.7-INCH GUN MATÉRIEL, MODEL OF 1906.

THE 4.7-INCH GUN, MODEL OF 1906.

WEIGHTS, DIMENSIONS, ETC.

Weight.....	pounds..	2,688
Caliber.....	inches..	4.7
Total length.....	do....	134.92
Length of bore.....	do....	129.42
Length of rifle portion of bore.....	do....	111.9
Number of grooves.....		42
Width of grooves.....	inches..	.2116
Depth of groove.....	do....	.04
Width of lands.....	do....	.14
Twist of rifling, right hand, 1 turn in 50 calibers at origin to 1 turn in 25 calibers at 14.9 inches from muzzle, thence uniform.		
Rifling, semicubic parabola in form.		
Travel of projectile.....	inches..	114.9
Weight of projectile, filled and fuzed, for base fuzed shell and shrapnel.....	pounds..	60
Weight of projectile, filled and point fuzes.....	do....	45
Weight of powder charge.....	ounces..	95
Weight of cartridge case.....	pounds..	8
Capacity of cartridge case.....	cubic inches..	251
Muzzle velocity, 60-pound shell and shrapnel, feet per sec- ond.....		1,700
Muzzle velocity, 45-pound shell ¹	feet per second..	2,050
Maximum pressure per square inch.....	pounds..	36,000
Maximum range at 15° elevation ¹	meters..	8,750
Maximum range at 25° elevation ¹	do....	11,100
Center of gravity of gun from rear face of breech....	inches..	51

DESCRIPTION.²

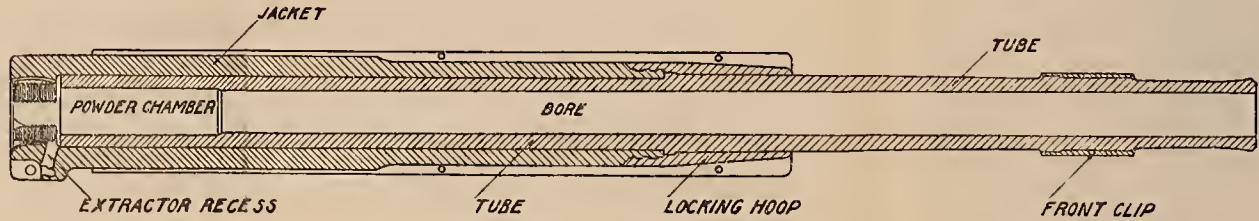
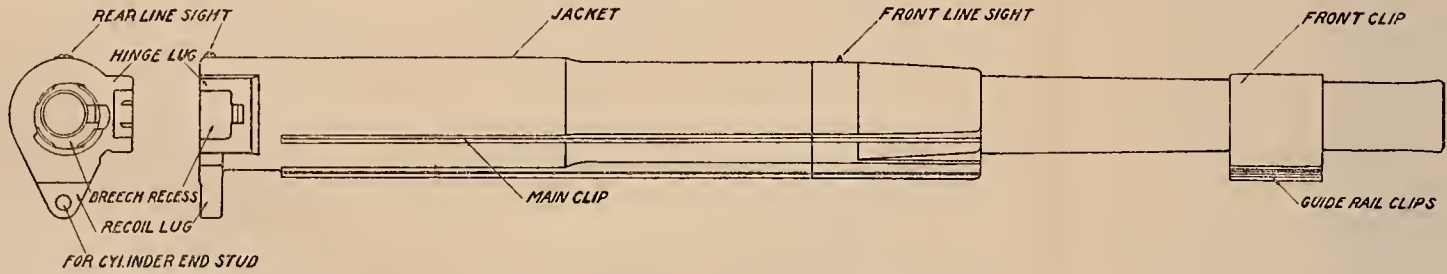
(Plate I.)

The 4.7-inch gun is built up consisting of a tube, jacket, locking hoop, and clip. Guns numbered 1 to 21, inclusive, are of gun steel; those after No. 21 are of nickel steel. The jacket envelops the rear portion of the tube and projects beyond it to form the breech recess

¹ Calculated values. Actual values will be in the range tables that are being prepared as fast as data is available.

² See note on page 15 in regard to guns numbered 2 to 53, inclusive.

4.7 IN. GUN. MODEL OF 1906.



HANDBOOK OF THE 4.7-INCH GUN MATÉRIEL, MODEL OF 1906.

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Travel of projectile.....	inches..	114.9
Weight of projectile, filled and fuzed, for base fuzed shell and shrapnel.....	pounds..	60
Weight of projectile, filled and point fuzes.....	do....	45
Weight of powder charge.....	ounces..	95
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Muzzle velocity, 60-pound shell and shrapnel, feet per sec- ond.....		1,700
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Center of gravity of gun from rear face of breech....	inches..	51

DESCRIPTION.²

(Plate I.)

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¹ Calculated values. Actual values will be in the range tables that are being prepared as fast as data is available.

² See note on page 15 in regard to guns numbered 2 to 53, inclusive.

or seat for the breechblock. A lug, known as the recoil lug, projects from the under surface of the jacket at its extreme rear end and affords a point of attachment for the recoil cylinder of the carriage. To this lug is also attached the spring rod yoke, to the ends of which are secured the spring rods. A lug in the right of the jacket at its rear end provides a point of support for the block carrier, which is held in place by the hinge pin. A seat for the extractor is also formed in this lug, passing through it into the breech recess.

The locking hoop's function is to secure the jacket from any longitudinal motion to the rear with respect to the tube. It is joined to the forward end of the jacket by means of a left-hand screw thread of one and one-eighth turns. A shoulder in the hoop bears against a shoulder on the tube. The locking hoop, in addition to being screw-threaded, is also assembled with a shrinkage.

The clip is a short hoop shrunk on the tube near the muzzle. A cylindrical surface having a shoulder is formed on the tube as a seat for the clip. In addition to the shrinkage the clip is secured by a pin driven transversely through the hoop near its rear end.

On each side of the gun and extending the full length of the jacket and locking hoop is formed a supporting clip. The bottom surfaces of these clips are parallel to the axis of the bore and are in contact with the top surfaces of the cradle rails on which the gun slides during recoil. On the underside of the gun and extending the entire length of the jacket, locking hoop, and clip are formed recoil guides or clips which fit under and secure the gun to the rails of the cradle and also serve to guide the gun during recoil.

When the gun is assembled upon the carriage a sheet-steel dust guard is secured to the front face of the locking hoop and the rear face of the clip, thus protecting from dust and dirt the bearing surfaces of the guide rails between these points. Eight oil holes closed by handy oilers are provided for oiling the guide rails and recoil surfaces.

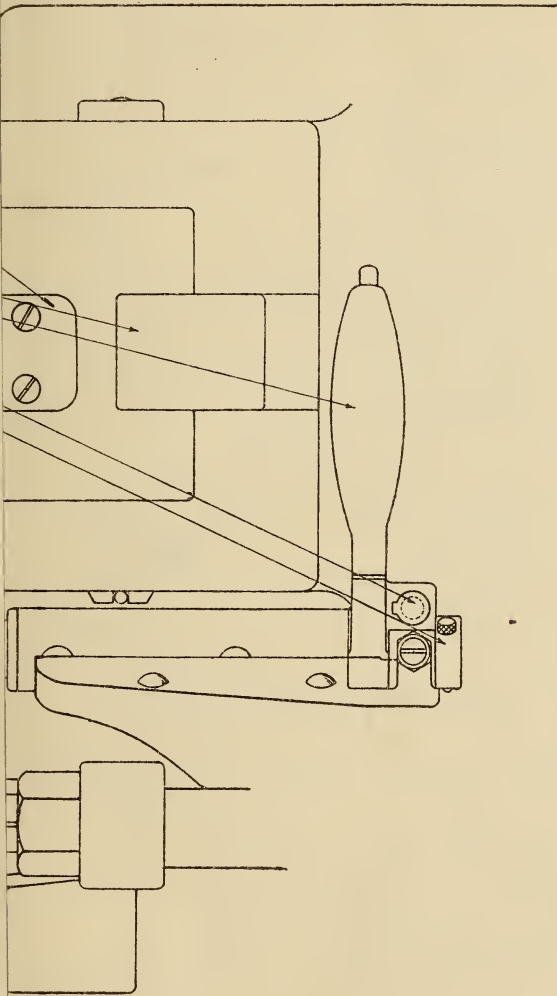
BREECH MECHANISM.

(Plate II and III.)

The breechblock is of the interrupted-screw type and is provided with four threaded and four slotted sectors. The front end of the axial recess in the block for the hub of the block carrier is closed by a bushing. Three vent holes leading from a cavity in the bushing to the rear through the breechblock permit the escape of gas from a ruptured primer. On a semicircular boss on the rear face of the breechblock are cut gear teeth, in which the gear teeth of the operating lever bevel gear mesh. The upper end of the circular boss on which the gear teeth are cut serves as a stop to limit the rotation of the block in the unlocked position. This upper end of the circular boss comes in contact with a hardened steel stop which is fastened by two screws to the outer face of carrier extending through and projecting from the inner face of block carrier.

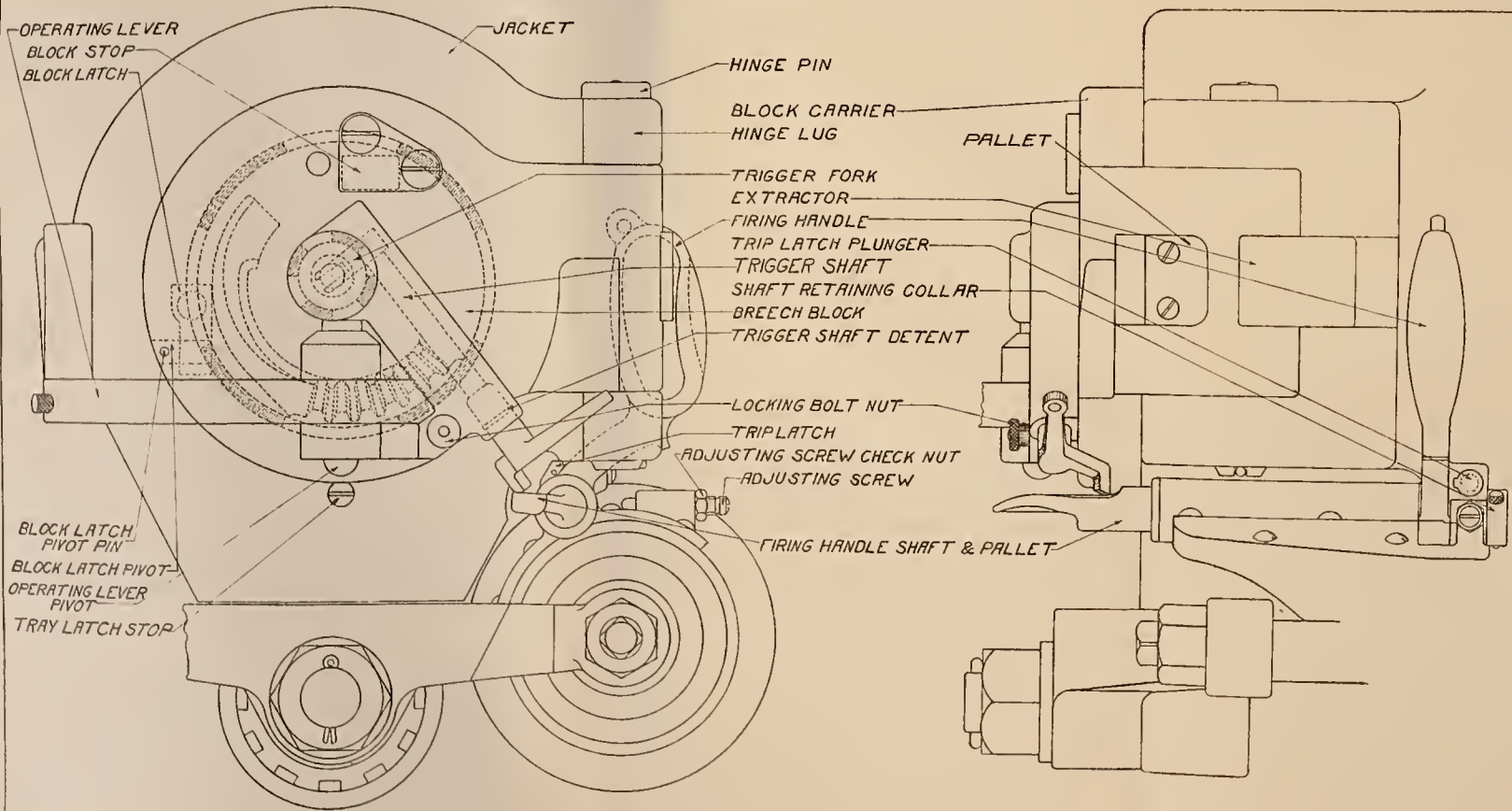
In order that no relative movement between the breech block and block carrier can take place, a block latch, pivoted on the inner

PLATE II



4.7 IN. GUN MODEL OF 1906
BREECH MECHANISM ASSEMBLY

PLATE II



CLASS 36. DIV. 2. DRAW. III.

PLATE I
THE GREAT TEMPLE
AT THE GREAT PYRAMID



Fig. 1

THE GREAT TEMPLE
AT THE GREAT PYRAMID
PLAN OF THE GREAT TEMPLE
AT THE GREAT PYRAMID



face of the carrier in the lower left-hand quadrant, engages a notch or shoulder cut in the rear face of the block adjacent to the circular hub on which the gear teeth are cut. This latch is so pivoted that as the mechanism is swung free from the gun it moves forward sufficiently to engage the notch in the block, and also to cause the forward plane of the latch to project beyond the front of the block carrier; consequently when the mechanism is swung to the closed position the front face of the latch comes in contact with the rear face of the breech of the gun, thus forcing the latch out of the notch in the breechblock back into a recess in the carrier, and by continuing the motion of closing the mechanism the breechblock is free to rotate on the hub of the carrier and engages its threads with those in the gun. Displacement of the firing lock case due to a blowback is prevented by four lugs on the firing lock case, which are arranged to interlock with corresponding lugs on the block carrier. The breechblock is mounted eccentrically in the breech of the gun, with reference to the axis of the bore, and is concentrically mounted on a hub on the block carrier, in which the firing lock case is fitted.

The firing lock case is eccentrically fitted in the hub of the block carrier in such a position that the axis of the firing pin is always in line with the bore of the gun. The bushing in the front end of the breechblock, through which the firing pin passes, when in the fired position is fitted eccentrically with reference to the breechblock and is provided with a cavity of such dimensions that the breechblock is permitted to revolve freely about the firing pin, which is fixed in the hub of the block carrier and does not rotate. The point of the firing pin, when at rest, is always within the enlarged cavity in the bushing, and when the block is revolved to the unlocked position, the hole in the bushing through which the point of the firing pin passes is moved to one side, due to the eccentric arrangement of the breechblock, thus masking the point of the pin and preventing any possible contact between the firing pin and the primer in the cartridge case when the block is unlocked. The block will be practically fully locked before any contact between the firing pin and the primer can take place. The firing pin is provided with a shoulder a short distance in rear of the forward end, which comes in contact with the rear face of the bushing if an attempt is made to fire the gun when the breech is unlocked. This is done to prevent any blow from coming on the point of the firing pin and injuring the same.

The loading tray is located in the breech recess and serves to protect the two lowest threaded sectors in the breech recess from being bruised by the cartridge when loading the gun. Its middle portion is cut away in order to clear the lowest threaded sector on the block when the latter is closed. It is locked to the gun when the breech is open by the tray latch which is located in the rear lower face of the jacket and engages a slot in the rear lip of the tray. The latch is so placed that as the block carrier strikes the face of the breech it forces the latch to disengage its seat in the tray. As the block rotates, its lowest threaded sector which engages the tray causes the latter to rotate, its front and rear lips sliding in seats provided for that purpose in the breech recess.

FIRING MECHANISM.

The firing mechanism belongs to that type known as a continuous pull mechanism; that is, the mechanism is cocked and fired by the pull on the lanyard or the downward pressure on the firing handle. This arrangement gives greater safety against prematures and permits of a quick repetition of the blow from the firing pin in case of a misfire.

FIRING PIN.

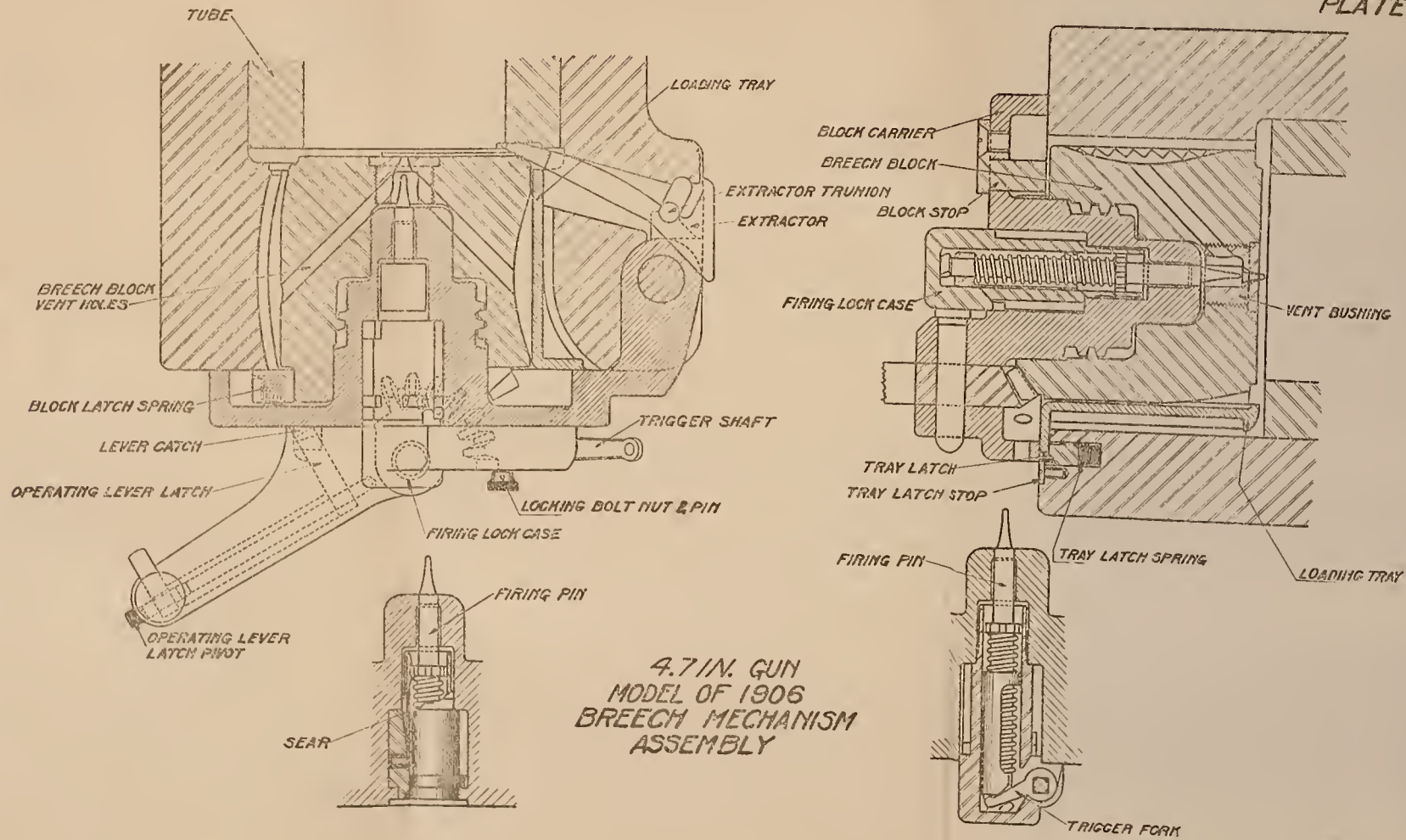
The firing pin is mounted in the firing lock case. Near its front end it is provided with a collar which serves to guide the pin axially, and as a shoulder for the front end of the firing spring. It also serves as a means for preventing the forward movement of the firing pin until the firing spring has been compressed by the action of the lanyard or firing handle. The rear end of the firing pin is rectangular in cross section and is provided with a double lug against which the trigger fork engages at a point between its upper end and its axis. The engagement serves as a means of forcing the firing pin to its retracted or normal position, after the pin has been released and forced forward. Opposite the double lug for the trigger fork, the firing pin is provided with a smaller lug, which fits into a slot in the firing spring sleeve and serves to hold the sleeve in its proper position for assembling the trigger fork. This provides a space between the rear face of the sleeve and the double lug on the firing pin. Through this space the trigger fork may be inserted by hand to its proper position.

FIRING PIN SPRING.

The firing pin spring is threaded over the firing pin from the rear end. Over this is assembled the firing spring sleeve in such a manner that when it is seated in its proper position the firing pin spring is put under an initial tension by being compressed between the collar on the front end of the firing pin and a shoulder or seat formed on the inside of the sleeve at its rear end. The rear end of the firing spring has a tang which fits in a recess drilled in the bearing surface of the firing spring sleeve.

SEAR.

The sear, which is in the form of a leaf spring, is seated in a slot in the firing lock case. It is provided with a thickened forward end, having a notch cut in it, in which a hardened portion of the periphery of the collar on the firing pin engages. Immediately in rear of this notch in the sear an inclined surface is provided, upon which the forward end of the firing spring sleeve acts in its forward motion to compress the firing pin spring and fire the gun. After the sleeve under the action of the trigger fork has traveled the required distance forward to produce the proper compression to the firing pin spring the sear is forced outward, thus releasing the engagement between the sear and the collar of the firing pin. The firing pin being



released moves forward under the action of the firing pin spring and fires the gun. On the rear end of the sear a cylindrical projection is formed which fits into a hole drilled into the firing lock case. This serves to hold the sear in place.

TRIGGER FORK.

The trigger fork is seated in the rear of the firing lock case and is constrained from displacement laterally by the walls of the firing lock case. It engages the squared end of the trigger shaft. The trigger fork is bifurcated on the end which engages the firing pin and sleeve, and it is seated so that the flat sides of the firing pin pass between the bifurcated end of the fork and the rear face of the bifurcated end bears against the front faces of the double lug on the firing pin at a point located about halfway between the end of the trigger fork and its axis. This point of contact between the firing pin and trigger fork is important, as it helps to maintain the proper operation of the firing pin in its return action after firing. The extreme bifurcated ends of the trigger fork are made in the form of a circle, and these ends bear against a flat surface on the rear end of the firing spring sleeve perpendicular to the axis of the sleeve. The fork does not touch the firing spring sleeve at any other point. The firing spring is under tension at all times and exerts an equal pressure between the collar on the front end of the firing pin and its seat in the rear end of the firing spring sleeve. The pressure on the firing pin collar is transmitted to the trigger fork at the bearing between the latter and the double lug on the firing pin, while the pressure on the spring seat in the sleeve is transmitted to the trigger fork at its extreme bifurcated ends. These two forces are equal and opposite in direction, but have different lever arms with respect to the axis of rotation of the fork. The fork is, therefore, acted upon by a varving couple the moment of which is sufficient, when the trigger shaft is released, to rotate the trigger fork to the rear, carrying with it the firing pin through the medium of the double lug on its rear end. This motion continues until the firing pin collar engages the sear, at which time the spring, sleeve, trigger fork, and firing pin are in the normal position and the firing mechanism again ready for action.

TRIGGER SHAFT.

The trigger shaft is assembled in a projection which forms a part of the firing lock case and is held in place by a wire detent. Its function is to rotate the trigger fork forward in firing. It has at its upper end a squared portion on which the fork is mounted. At its lower end are two projections, the larger of which is provided with a hole for the attachment of a lanyard by which the gun should be fired until the spade at the end of the trail is sufficiently embedded in the ground to hold the carriage in place. The other projection on the trigger shaft is acted upon by the firing pallet, which is an extension of the firing handle shaft. This latter arrangement serves as a means of firing the gun from a seat on the carriage.

FIRING LOCK CASE.

The firing lock case is designed to contain the complete firing mechanism. By this means the entire firing mechanism can be replaced in an instant. It contains the firing pin, firing pin spring, firing spring sleeve, sear, trigger fork, trigger shaft, and detent. It is provided with four lugs by which it is locked in place in the hub of the block carrier.

The firing lock case is held from displacement due to rotation by a spring catch or locking bolt. This locking bolt is fitted in a projection of the firing lock case and the inner end enters a recess or seat in the rear face of the block carrier.

OPERATING LEVER.

The handle and body of the lever is recessed to receive the lever latch. The inner end of the lever is provided with beveled gear teeth, which mesh with corresponding teeth on the breechblock and serve as a means for opening and closing the mechanism. The lever is seated between two lugs on the block carrier and is held in place by a pivot.

BLOCK CARRIER.

The block carrier is hinged at its right side to the gun by means of the hinge pin. It is provided with a central inwardly projecting hub on which a left-hand thread of one and a half turns is cut, upon which the breechblock is concentrically mounted. The hub is bored out eccentrically to receive the firing lock case, which is held in place from axial displacement by four lugs formed on the firing lock case and four lugs formed on the inside of the bore of the block carrier. Two lugs are formed on the rear face of the carrier just below its center. They form a seat for the operating lever. On the inner face in the lower left-hand quadrant a seat and pivot for the block latch is provided. In the upper right-hand quadrant on the outer face a block stop is screwed which has a steel lug that extends through and projects from the inner face of the carrier. This limits the rotation of the block in the open position. On the right side of the carrier a projecting pallet is attached which serves to operate the extractor.

BLOCK LATCH.

A recess in the latch contains a spring which presses against the inner face of the block carrier, forcing the latch forward into its locking recess in the block, when the breech is open. When the block is locked, the latch rests against the rear face of the jacket. The latch serves to prevent rotation of the block when in its open position.

THE EXTRACTOR.

The extractor is located in a seat formed in the jacket. It is operated by the block carrier, the pallet on the latter serving to give it a quick throw at the end of the swing of the carrier in opening the

mechanism. The extractor rolls on its forward or convex face and is prevented from being displaced by its trunnions, which slide in grooves formed in the top and bottom of the extractor seat. A lip in the extractor engages the rim of the cartridge case and serves as a means for ejecting the same.

OPERATING LEVER LATCH.

The latch is fitted in a seat formed in the operating lever and serves to lock the handle from rotation, which in turn prevents rotation of the block. The latch rotates about a long steel pivot, which is so fitted that it interlocks with the lever latch under the action of the lever latch spring.

HINGE PIN.

This is a hardened steel pin, and is held from displacement by a spring catch fitted to its lower end. A handy oiler seated in its top surface supplies oil to a spiral groove formed on its surface.

ACTION OF THE BREECH MECHANISM.

To open the breech, grasp the operating lever handle; at the same time compress the lever latch handle. This releases the latch from the catch on the block carrier. Rotate the operating lever to the rear. During the first part of this movement ($67\frac{1}{2}^\circ$) the block and loading tray are rotated to their unlocked positions, at which time the stop on the block comes in contact with the stop on the block carrier and the tray latch opposite its seat in the loading tray. The block latch will drop into its notch in the block and the tray latch engage the tray at the moment of swinging the block carrier from the gun. The block is now locked against further rotation in either direction. During a further rotation of the operating lever of about 101° the block and block carrier swing about the hinge pin clear of the breech recess, the block carrier operates the extractor, unseating the cartridge case before the end of the 90° movement, and finally, as the pallet on the block carrier engages the extractor, the latter is given a quick throw which ejects the case free of the gun.

When another round is inserted the rim of the cartridge case comes in contact with the extractor and forces it partly home. In closing the mechanism the movements are simply the reverse of opening; as the block comes in contact with the breech face of the gun the block latch is forced rearward, the tray latch forward, unlocking the block from the block carrier and the loading tray from the gun. Further rotation of the operating lever rotates the breechblock and loading tray, causing the threads of the former to engage those of the gun. This engagement of threads moves the block forward, due to the pitch of the threads, and firmly seats the cartridge in the chamber. At the final motion of the operating lever its latch engages the catch on the rear face of the block carrier, locking the block in the closed position. The gun is now ready to fire.

TO DISMANTLE THE FIRING MECHANISM.

Take hold of the locking bolt situated at the lower end of the firing lock case, pull it to the rear, then revolve the firing lock case upward about 45° and pull it gently to the rear. This will remove from the gun the firing lock case with the firing mechanism complete. Press the trigger shaft detent until it disengages from the notch in the firing lock case. This will allow the trigger shaft, with its detent, to be withdrawn. Then gently press on the front of the firing pin, forcing it back into the firing lock case. This will allow the trigger fork to be removed. Then, with one finger placed on the front end of the sear, force it outward; at the same time grasp the front end of the firing pin. Give it a sharp pull. This will remove the firing pin spring and sleeve from the firing lock case. Then place the front end of the firing pin against a block of wood, bear down on the firing spring sleeve until the spring is compressed sufficiently to disengage the slot in the rear end of the sleeve from the small lug on the rear end of the firing pin. Slightly turn the sleeve, and it can be separated from the spring and pin. By an unscrewing motion the spring can be removed from the pin. The sear can be removed by gently pressing it toward the center of the firing lock case.

To assemble, reverse these operations, taking care before driving too hard on the end of the trigger shaft that the square hole in the trigger fork is in position to receive the tapered end of the trigger shaft. No tools are required for assembling or dismantling the firing mechanism except possibly a small rod or stick to pry out the trigger fork.

TO DISMANTLE THE BREECH MECHANISM.

Grasp the operating lever and open the mechanism; when the mechanism is open, remove the firing lock case; force the pivot of the operating lever up and remove the lever. Take out screws retaining block stop and remove the block stop. Force the block latch out of its seat in the block by pressing it into its seat in the carrier; take hold of the block and revolve it to the right until the threads of the block are disengaged from the threads on the hub; then pull the block to the rear. The block latch can now be readily removed. The lever latch can be removed by pressing in on the latch at a point near its lower end and opposite its pivot. A hole in the latch is cut eccentric with reference to the pivot, and a shoulder on the pivot prevents their displacement until the latch is forced in and the hole is concentric with the pivot. When this occurs, the pivot can be readily pulled out and the latch removed. To remove the block carrier, force the hinge pin up by hand until it can be caught by the head; if the pin sticks, by swinging the block carrier back and forth it can readily be loosened. The extractor can now be removed from its seat. Pressing on the tray latch sufficiently to force it into its seat permits the loading tray to be removed from the breech recess. Reverse these operations for assembling the mechanism.

CARE OF THE GUN.

After firing, the bore of the gun should be cleaned to remove the residue of smokeless powder, and then oiled. In cleaning, wash the bore with a solution made by dissolving one-half pound of sal soda in 1 gallon of boiling water. After washing with the soda solution, wipe perfectly dry, and then oil the bore with a thin coating of the slushing oil furnished for the purpose. A slush brush for use in oiling the bore will be issued by the Ordnance Department upon requisition.

The breech mechanism should be kept clean and well oiled. It should be dismounted from time to time for examination and oiled when assembled.

GUNS 2 TO 53.

The foregoing description of the breech and firing mechanism applies to guns numbered above 53. The following changes in description will apply to guns numbered from 2 to 53, inclusive. The points of difference on these guns are that the hub of the carrier is not threaded to the breechblock and the block stop is riveted to the inner face of the carrier.

BREECH MECHANISM.

The upper end of the circular boss on which the gear teeth are cut comes in contact with a hardened-steel stop riveted to the inner face of the block carrier. A radial lug or tooth projects from the inner surface of the breechblock and engages an L-shaped slot cut in the hub of the block carrier, so that when the mechanism is unlocked no relative movement between the breechblock and the block carrier can take place.

When the breechblock is in the locked position, a lug on the firing lock case engages the front face of the tooth or lug on the breechblock, which locks the breechblock to the block carrier. This engagement between the lug on the breechblock and the lug on the firing lock case serves to lock the block carrier to the breechblock and prevent displacement due to a blowback.

FIRING LOCK CASE.

It is provided with four lugs by which it is locked in place in the hub of the block carrier, and one lug forward of the other four, which engages behind a lug on the breechblock. This lug, together with the other four which lock the case to the carrier, serves to lock the block and carrier together.

BLOCK CARRIER.

In the forward end of the central hub a slot is cut which extends to the rear and terminates in an L. This receives the lug on the breechblock and holds the block from displacement when the mechanism is open. In the upper right-hand quadrant on the inner face a hardened-steel block stop is riveted. This limits the rotation of the block in the open position.

TO DISMANTLE THE BREECH MECHANISM.

Grasp the operating lever and open the mechanism; when the mechanism is open, force the block latch out of its seat in the block by pressing it into its seat in the carrier. Take hold of the block and revolve it to the left until it stops; then pull it to the rear off the carrier.

NOMENCLATURE OF PARTS OF GUN AND BREECH MECHANISM.

NOTE.—In all reports and correspondence the gun and breech mechanism should be designated by the number, model, etc., as stamped thereon. When requisitioning replacement parts, the parts desired should be referred to by the names given in the nomenclature of parts herein, and the piece numbers should be copied exactly as stamped upon the unserviceable pieces.

Number required.	Name of part.	Location.	Property classification.	
			Class.	Section.
1	Block carrier.....	Hinged to right side of jacket..	IV	3
1	Block latch.....	Left inside face of carrier.....		
1	Block latch spring.....	Recess in block latch.....		
1	Block stop.....	Upper right quadrant of carrier		
1	Breech block.....	Carried on hub of carrier.....		
1	Block stop support.....	Abutting against block stop on the right.		
2	Block stop screw.....	Securing block stop.....		
1	Clip.....	Encircles tube near the muzzle.		
1	Extractor.....	In recess right side of jacket....		
1	Firing lock case.....	On outer face of carrier.....		
1	Firing pin.....	In firing lock case.....		
1	Firing spring.....	Encircles firing pin.....		
1	Firing spring sleeve.....	Encircles rear of firing spring...		
1	Front line sight.....	On top of locking hoop.....		
1	Hinge pin.....	Held in lugs at right of jacket....		
1	Hinge pin catch.....	In bottom part of hinge pin....		
1	Jacket.....	Over rear half of tube.....		
1	Latch pivot.....	Left of carrier, through block latch.		
1	Lever latch pivot.....	Inside of operating lever.....		
1	Lever catch.....	Lower left quadrant of carrier face.		
1	Lever catch screw.....	Secures lever catch.....		
1	Lever latch.....	Inside operating lever and handle.		
1	Lever latch spring.....	In handle of operating lever....		
1	Liner.....	Inserted in tube after re boring.		
1	Liner key.....	Rear end of tube and liner.....		
1	Loading tray.....	In breech recess.....		
1	Locking bolt nut.....	Firing lock case.....		
1	Locking bolt pin.....	Through locking bolt nut.....		
1	Locking bolt spring.....	Encircles locking bolt nut.....		
1	Locking hoop.....	Encircles tube forward of jacket.		

Number required.	Name of part.	Location.	Property classification.	
			Class.	Section.
1	Locking bolt knob.....	Head of locking bolt nut.....	IV	3
1	Operating lever.....	Pivoted to outer face of carrier.		
1	Operating lever pivot.....	Held in lugs on outer face of carrier.		
1	Pallet.....	On right of carrier.....		
2	Pallet screw.....	Secures pallet.....		
1	Pivot pin.....	Secures latch pivot.....		
1	Plug.....	Firing lock case.....		
1	Rear line sight.....	On top of rear end of jacket.....		
2	Rear line sight screws.....	Secure rear line sight.....		
1	Sear.....	In firing lock case.....		
1	Tray latch.....	In jacket directly below breech recess.		
1	Tray latch spring.....	Behind tray latch.....		
1	Tray latch stop.....	Screw retaining tray latch.....		
1	Trigger fork.....	At head of trigger shaft.....		
1	Trigger shaft.....	In firing lock case.....		
1	Trigger shaft detent.....	At base of trigger shaft in firing lock case.		
1	Tube.....	Interior of gun.....		
1	Vent bushing.....	Inside face of breech block.....		

AMMUNITION.

(Plates IV, V, VI, VII, VIII, IX, and X.)

Fixed ammunition is used in the 4.7-inch gun and is made up with shrapnel or with two types of high explosive common steel shell, either base fuze or point fuze. The rounds as made up vary slightly in length with the type of projectile used. Battery ammunition chests are of sufficient size to take each kind of ammunition furnished. The number of each type to be carried is subject to regulation by proper authority. Shrapnel and base fuze common steel shell are issued filled and fuze. The point fuze common steel shell is issued filled and containing an adapter and booster casing with booster charge of high explosive. These point fuze shells are never issued fuze, owing to the sensitiveness of the fuzes when combined with the adapter and booster casing. Under no circumstances should they be carried fuze in caissons or limbers after having been fuze in the field. Base fuze common steel shell and common shrapnel weigh 60 pounds; point fuze steel shell weighs approximately 45 pounds. The components of each round are, the cartridge case with primer, the powder charge, projectile, and fuze.

CARTRIDGE CASE.

(Plate IV.)

The cartridge case is a solid drawn brass case 16.6 inches long. It has a capacity of 251 cubic inches, and weighs with primer 7.875 pounds. The head or base of the case has a projecting flange or rim under which the lip of the extractor engages. The center of the base is bored out to form a seat into which the primer is forced. The primer seats are mandreled to near finished dimensions with a tapered steel plug to toughen the metal of the cartridge case around the primer seat and then reamed to finished size. This toughening is necessary to prevent expansion of the seat under gas pressure with a consequent looseness of the primer after repriming. The primer is inserted in the case by means of a primer inserting press to avoid injury to the primer seat or explosion of the primer. Special decapping tools are issued for use in removing exploded primers from cartridge cases.

A circular groove is cut in the base of the cartridge case and is painted red to indicate rounds of shrapnel with 31-second fuze designed prior to war contracts.

Subsequent 31-second shrapnel and 45-second shrapnel rounds will not be marked so, but will be identified by the fuze itself. High explosive point detonating 45-pound shell rounds will have a black stripe painted across the base of the cartridge case.

THE PRIMER.

(Plate IV.)

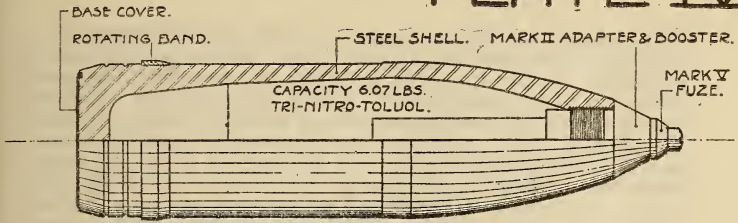
To insure the ignition of smokeless-powder charges in cartridge cases it is necessary that the primers either contain in themselves, in addition to the percussion composition, an auxiliary charge of black powder, or that an auxiliary charge of such powder be placed at the rear of the cartridge case to communicate the flame from the percussion primer and thoroughly ignite the smokeless powder. The percussion primer is known as the 110-grain percussion primer and contains an ignition charge of 110 grains of black powder in addition to the essential elements of a percussion primer.

The 110-grain percussion primer is shown in Plate IV, and consists of a brass case resembling in shape a small-arms cartridge case. The head or rear end of the primer case is countersunk, forming a cup-shaped recess, in which is seated the cap or percussion primer proper. The latter consists of the cup, the anvil, and the percussion composition, assembled as shown on Plate IV.

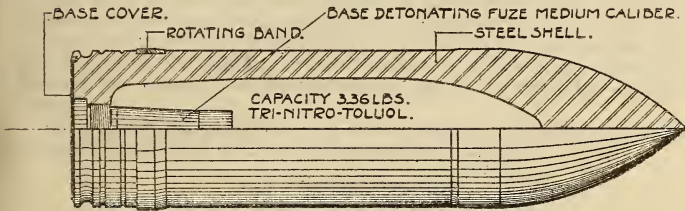
The percussion composition is known as the No. 70 mixture, and contains the following ingredients:

	Per cent.
Antimony sulphide.....	17
Potassium chlorate.....	53
Trinitrotoluene.....	5
Lead sulphocyanate.....	25

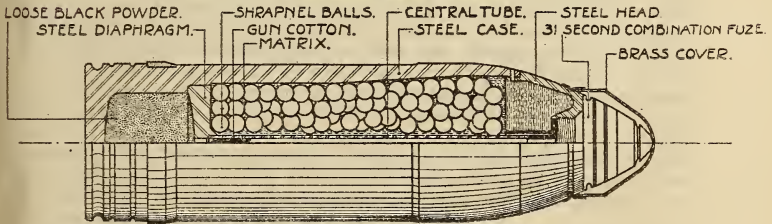
PLATE IV



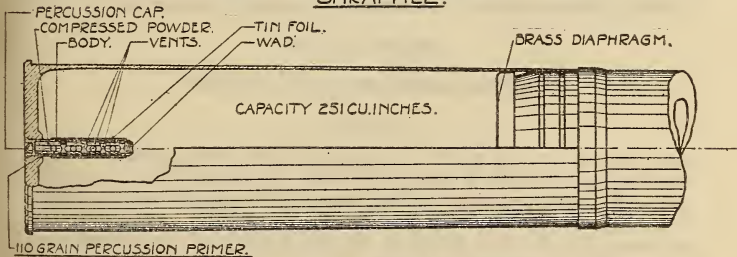
COMMON STEEL SHELL MARK II.



COMMON STEEL SHELL MODEL OF 1905.



SHRAPNEL.



CARTRIDGE CASE.

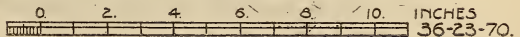


PLATE IV



FIG. 1



FIG. 2

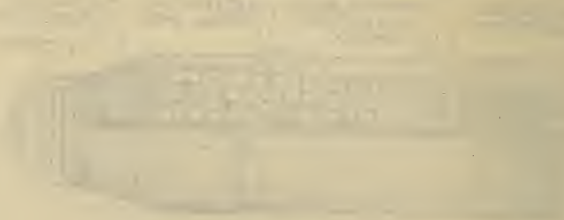


FIG. 3

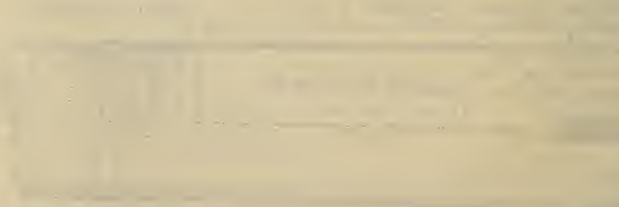


FIG. 4

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The percussion cap recess is connected with the interior of the primer case by a small vent. The body of the case contains 110 grains of black powder, constituting the rear "priming" or igniting charge for the smokeless powder. This black powder is inserted under a pressure of 36,000 pounds per square inch, and is pressed into the primer body around a central wire, which is then withdrawn, leaving a longitudinal hole the full length of the primer. Eight radial holes are drilled through the primer and compressed powder, affording 16 vents for the free exit of the black powder flames. After filling the case the front end of the case is closed by a cardboard wad covered with shellac, and the radial perforations in the body of the case are covered by a tinfoil wrapper to retain in the case any loose black powder, as well as to exclude all moisture.

In action, the blow of the firing pin explodes the percussion cap, which ignites the black powder; the flames of the latter shoot out through the vents in the primer case and ignite the smokeless-powder charge.

The primer just described and known as the 110-grain percussion primer is used only with smokeless-powder charges.

THE POWDER CHARGE.

The powder charge is a nitrocellulose powder, composed of multi-perforated (7 perforations) cylindrical grains. The charge varies slightly for different lots of powder, but is approximately 95 ounces for 60-pound projectile and 112 ounces for 45-pound projectile. The granulation is determined so that the charge occupies about nine-tenths the space in the cartridge case, in rear of the projectile. In making up the cartridges a brass diaphragm is soldered in place next to the powder charge to avoid the possibility of moisture reaching the powder charge or the primer. The charge gives a muzzle velocity of 1,700 feet per second, with a maximum pressure in the bore not exceeding 33,000 pounds per square inch for 60-pound projectile and 2,050 feet per second for 45-pound projectile with a maximum pressure not exceeding 37,000 pounds.

Service smokeless powder *must not be used* for blank cartridges. For that purpose the Ordnance Department furnishes special powder.

PROJECTILES.

60-POUND COMMON STEEL SHELL.

(Plate IV.)

The common steel shell is shown in Plate IV. It is provided with an ogival head struck with a radius of 2 calibers, and is fitted with a copper rotating band forced into an annular groove 1.9 inches from the base. Between the band and the base are cut three circumferential grooves, the front one of which is filled with material insuring a waterproof joint in the assembled cartridge. This groove and the middle groove are used as crimping grooves. The rear groove, which is somewhat deeper than the others, is to allow the

projectile to be readily gripped to remove it from the caisson or limber when it is used as separate loading ammunition in the 4.7-inch howitzer. In assembling the ammunition the shell is forced into the cartridge case up to the band, and the metal of the cartridge case is then set into the crimping grooves at several points, securely fixing the projectile in the case. The base of the shell is tapped for a base detonating fuze, medium caliber, and is fitted with a copper base cover secured in the base cover groove by lead calking wire. The base cover consists of a copper cover, and a lead disk lying between the cover and the projectile. The base cover seals the joint between fuze and shell against the entrance of powder gases into the shell cavity. The shell contains a bursting charge of 3.36 pounds of trinitrotoluol. The weight of the shell, with bursting charge and fuze, is 60 pounds. The shell is always issued filled and fuzed.

POINT DETONATED SHELL.

Common steel shell to accommodate three types of point detonating fuzes, also a gas-filled common steel shell, to be fired with an instantaneous action point fuze, are the point fuzed shells for use with the 4.7-inch gun.

45-POUND COMMON-STEEL SHELL, MARK I.

(Plate IV.)

This shell has an ogival head struck with a radius of 4.52 calibers and is fitted with a copper rotating band forced into an annular groove 1.9 inches from the base. About 0.5 inch and 1 inch, respectively, below the rotating band, two circumferential grooves are cut to receive the crimping on of the cartridge case.

In assembling the round the shell is forced into the case up to the band and the metal of the case is set into the grooves at several points, securely fixing it.

Point fuzes only are used with this shell, which is tapped through the nose to receive the adapter for French type fuzes. The base cover consists of a lead disk covered by a brass base cover which is crimped into an undercut groove and calked with lead wire. This cover prevents danger of premature ignition of the bursting charge through penetration of flame while in the gun. The bursting charge consists of 6.07 pounds of cast T. N. T. or amatol. The weight of the shell, including bursting charge, adapter, and fuze, is approximately 45 pounds. The three fuzes vary in weight from 0.6 pound to 1.2 pounds. The shell is never issued fuzed. Shell fuzed in the field should be unfuzed before being carried in caissons or limbers.

COMMON-STEEL SHELL, MARK I, GAS FILLED.

The shell body of the 4.7-inch gas shell is identical with the point fuzed common-steel shell, except that it has no base cover, and that the tap hole to receive the adapter is tapered to make a gas-tight joint. The gas charge consists of phosgene or other gas which is

liquefied by cooling to -15° F. and poured in. A sufficient space is left to allow for expansion when the gas regains atmospheric temperature. The screwing in of the adapter seals the gas hermetically in the shell body. A booster charge, similar to the one used to explode the common-steel shell, is located in the adapter and is sufficient to open the nose of the shell and release the gas. Any of the fuzes used with the common-steel shell will fit the gas shell.

SHRAPNEL.

(Plate IV.)

The shrapnel is a base charged shrapnel fitted with a combination fuze. The case is of forged steel with a solid base. The rotating band is forced into an annular groove cut in the case 1.9 inches from the base. The front or mouth of the case is closed by a steel head, screwed in and tapped to take the service 31-second or 45-second combination time and percussion fuze. The method of assembling the shrapnel to the cartridge case is the same as that described above for the common-steel shell. The bursting charge is composed of a charge of loose black powder (9.44 ounces). The bursting charge, thus arranged, is covered by a steel diaphragm. The diaphragm supports a steel central tube, which extends forward to the fuze, and thus affords a conduit for the flames from the fuze to the bursting charge. At the lower end of the central tube a stopper consisting of a paper cup is fitted to prevent the loose powder charge from getting into the tube. The shrapnel filling is composed of 793 balls, each approximately 212 grains in weight. The balls are approximately 0.54 inch in diameter. The balls are poured around the central tubes and rest upon the steel diaphragm. The interstices contain a smoke-producing matrix of rosin. The matrix, in addition to serving as a smoke producer, also assists to prevent deformation of the lead balls.

In action the case is not ruptured by the explosion of the bursting charge; the head is stripped and the balls are shot out of the case with an increase of velocity of about 275 feet per second. The remaining velocity of the shrapnel at 9,700 yards is approximately 892 feet per second, and the time of flight 31.6 seconds, so that at that range, with the increase of velocity due to the bursting charge, this shrapnel, with the 31-second fuze, is an efficient projectile. The addition of the 45-second combination fuze makes the shrapnel effective to the extreme range of the gun. With fuze, the shrapnel weighs 60 pounds.

FUZES.

COMBINATION FUZES.

These are point fuzes for use with shrapnel. They combine time and percussion elements. Because they are set by turning a graduated ring carrying part of the time train, they are known as ring or "dial" fuzes. They may be reset as often as necessary. The parts are made up for the most part from brass and bronze.

FRANKFORD ARSENAL 31-SECOND COMBINATION FUZE.

(Plate V.)

This fuze consists of the following parts, assembled as shown in Plate V:

- (a) Body.
- (b) Closing cap.
- (b¹) Vents in closing cap.
- (b²) Safety wire.
- (c) Upper time train ring.
- (c¹) Washer for graduated time-train ring felt cloth.
- (d) Time train ring, graduated.
- (d¹) Washer for body, felt cloth.
- (d²) Rotating pin.
- (e) Concussion plunger.
- (e¹) Concussion resistance ring.
- (f) Firing pin.
- (g) Vent leading to upper time train.
- (h) Compressed powder pellet.
- (i) Upper time train, compressed powder.
- (j) Compressed powder pellet in vent leading to lower time train.
- (j¹) Compressed powder pellet in lower time train vent.
- (k) Lower time train, compressed powder.
- (l) Brass disk, locked in place.
- (m) Compressed powder pellet in vent o.
- (o) Vent leading to magazine.
- (p) Powder magazine.
- (q) Percussion plunger.
- (r) Percussion primer.
- (s) Vents leading from percussion primer to magazine.
- (u) Bottom closing screw.
- (v) Washer for closing screw, muslin.
- (w) Washer for closing screw.

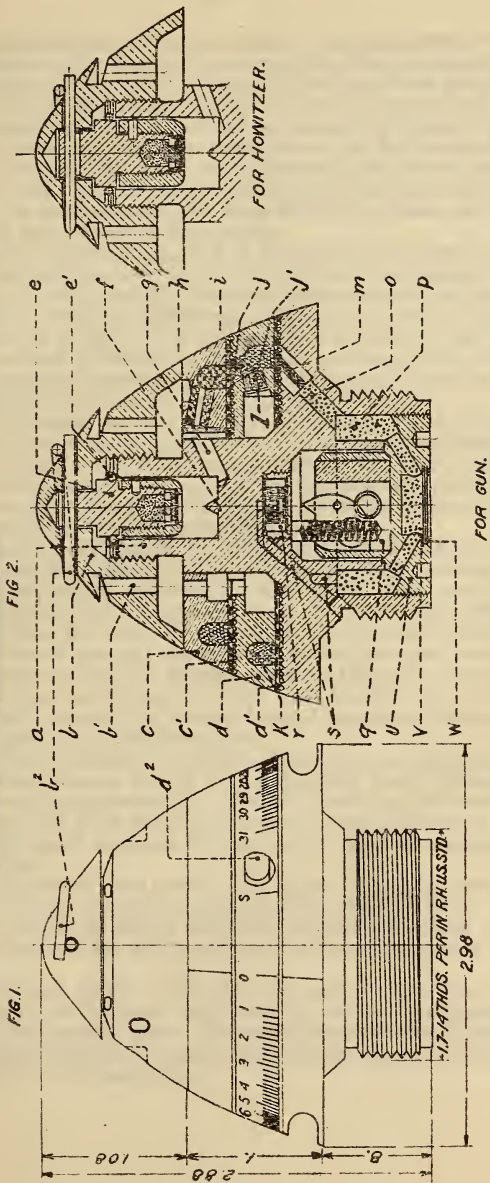
In the lower face of each ring a horseshoe-shaped annular groove is milled. Meal powder is compressed into these grooves under 51,000 pounds pressure per square inch, forming the time train. The time train in both grooves totals 12.35 inches in length.

The principal parts of the time element in this fuze are: The time or concussion plunger (e), the concussion resistance ring (e¹), the firing pin (f), the vent leading to the upper time train (g), the compressed powder pellet (h), the upper time train (i), the compressed powder pellet in the vent (j), the lower time train (k), the compressed powder pellet (m) in the vent (o) leading to the powder magazine.

The plunger (e) is cylindrical and contains the primer composition in a recess in its base. The concussion resistance ring (e¹) prevents contact of the primer and firing pin by supporting the weight of the plunger which rests upon it. The acceleration of the projectile during discharge causes the plunger, through inertia, to spread the ring and bring the primer into contact with the firing pin. Thus begun, the functions of the important parts are best explained by

PLATE V

31 SECOND COMBINATION FUZE.



REVISED DEC. 22, 1916. DEC. 12, 1917.

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the following description of the time action: Assume first the "zero" setting as shown in the figure; the concussion plunger arms and fires its primer at the discharge of the gun. The flame from the primer passes out through the vent (*g*) which is drilled through the walls of the concussion plunger chamber and is exactly opposite a hole in the inner surface of the upper time train at its farthest end. At the "zero" setting the vents are registered, the flame passing directly down vent (*j*) to the beginning of time train (*k*), then through the vent (*o*) to the magazine (*p*), from which the flames are transmitted to the base charge of the shrapnel.

Assuming any other setting, such as 12 seconds, the rotation of the graduated ring so that zero is 12 divisions from the datum mark, separates the vents (*j*) and (*g*), stopping direct access to the train (*k*) and forcing the flame to travel counterclockwise until it reaches the new position of vent (*j*), then pass down to train (*k*) and back, clockwise, to vent (*o*) where it ignites the powder pellet (*m*) and explodes the powder magazine (*p*). The lower time train is graduated in a clockwise direction on its outer edge from 0 to 31.6

For the 31.6-second setting the vent (*j*) leading to the beginning of the lower time train is opposite the end of the upper time train and the end of the lower time train is opposite the vent (*o*) leading to the powder magazine. It will now be seen that the entire length of time train in both rings must be burned before the flame can reach the magazine (*p*) and burst the shrapnel.

A safety setting is obtained by utilizing the solid surfaces of the upper and lower time train rings left between the ends of the annular grooves. This point is marked by a line on the outer edge of the movable time train and surmounted by an "S," and is located about halfway between the zero mark and the 31.6-second graduation. When this point is brought opposite the datum line, the vent (*j*) is rotated to beneath the solid metals separating the ends of the upper time train in the upper ring, while the vent leading to the powder magazine (*p*) is covered by the solid metal separating the ends of the lower time train in the lower ring.

With the fuze set at safety, the upper time train may burn entirely out if the time plunger should be accidentally fired, without the flame reaching the magazine (*p*). The solid metal of the lower ring covering vent (*o*) gives additional safety in case of a gas or flame leakage. The safety setting is the one used to cause the shrapnel to burst on impact.

Washers (*c'*) and (*d'*) are glued to the upper face of the graduated time ring and to the upper face of the flange of the fuze stock. Both surfaces are scored as shown to make the washers adhere firmly. The washers act as a gas check and prevent premature action of the fuze.

The compressed pellet (*j'*) in the vent leading from the outside to the beginning of the lower time train is to release the pressure of the gases of the burning train. Escape of the gases from both time trains is through the annular spaces, shown in the illustration, and out the vents (*b'*) in the closing cap.

The percussion element of the fuze as shown in the plate consists of a centrifugal percussion plunger (*q*) and an ordinary percussion primer (*r*). The centrifugal plunger (*q*) is provided with a slot to receive the firing pin, which is mounted on a fulcrum and kept in the unarmed position by two pins which fit in recesses on opposite sides of the plunger by the tension of the springs. These springs are designed to suit the velocity of rotation of the particular projectile in which the fuze is used. Centrifugal force due to the rotation of the projectile forces the pins outward against the tension of the springs, releasing the firing pin, which is also rotated into its armed position by centrifugal force. Two spring housings hold the entire plunger and its housing away from the primer during handling, transportation, and flight.

The system of vents through the walls of the fuze shown in figure 2 conduct the flame from the percussion primer to the magazine (*p*).

The bottom closing screw (*v*) closes the percussion plunger recess and keeps the powder in the magazine. The muslin washer (*v*) is shellaced and held by the brass washer (*w*). A projecting lip is crimped over the edge of the washer from the under edge of the bottom closing screw.

These fuzes are assembled in shrapnel. For transportation in limbers and caissons, the fuze should always be set at the safety point.

A hermetically sealed waterproof hood of thin brass is provided for the fuze. The hood should be stripped off before attempting to set the fuze. Remove the safety wire before setting the fuze, and replace the wire if the round is not fired. If the safety wire can not be replaced the round should not be carried in ammunition chests, or roughly handled, and should be fired at the next firing.

BASE DETONATING FUZE.

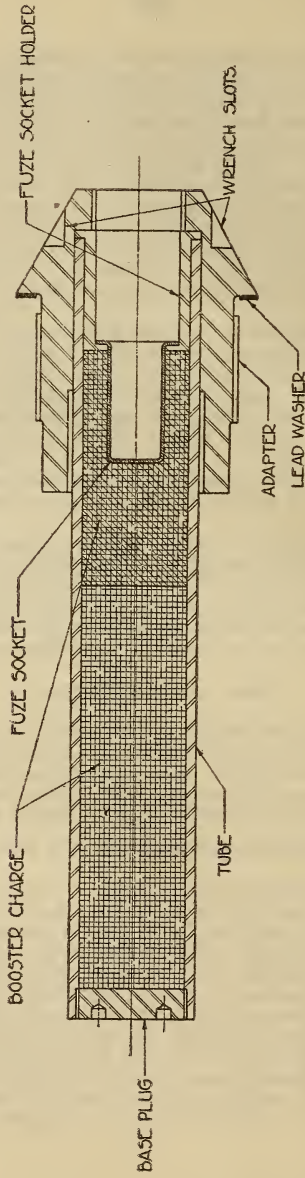
The base of the 60-pound shell is tapped for the medium caliber base detonating fuze, the percussion plunger of which is similar to that used in the combination fuze. Under no conditions should this fuze be disassembled when recovered in unexploded shell, as fatal accidents are known to have occurred from such action.

ADAPTER AND BOOSTER CASING, MARK II.

For French 24/31 fuzes: To adapt the French type point detonating fuzes Mark III and Mark V to the 4.7 shell, an adapter embodying a high explosive booster is used which is shown in Plate VI. The adapter consists of a flanged steel collar, threaded on the outside with a standard thread to screw into the head of the shell up to the flange. The inner circumference below the flange is also threaded to receive the steel tube constituting the booster casing.

Through the flanged section the collar is threaded to receive the French threading on the fuze stocks. A tubular fuze socket holder of steel is fitted to the inside of the booster casing. It has an inner lip which supports the outer lip of the copper or brass fuze socket, which is passed through it and soldered fast.

PLATE VI



ADAPTER AND BOOSTER CASING - MARK II.

In assembling, the lower end of the booster casing is filled with 214 grains of T. N. T. under pressure of 5,000 pounds per square inch, followed by 214 grains of tetryl, which is packed up and around the fuze socket under pressure of 5,000 pounds to the square inch, and held in place by a felt washer. This washer encircles the fuze socket at its juncture with the fuze socket holder.

Screwing the booster casing into the adapter plug brings the upper lip of the fuze holder tightly against the upper rim of the booster casing, holding the entire contents of the casing fast.

The adapter and booster are now ready to be screwed into the shell. As the fuzes are never assembled to the shell until the round is about to be used, an adapter plug is supplied which acts as a protection against the entrance of foreign substance or moisture into the socket. It consists of a compressed felt washer held between an upper washer of tin and a lower washer of copper, both held together by a twisted wire link. This link is first passed over the circumference of a ring which acts as a handle and means of unscrewing the plug.

ADAPTER AND BOOSTER CASING, MARK IV.

For 4.7 gas shell: Owing to the necessity for a gas-tight joint in this shell, the booster casing is made of a single tube of steel and the adapter is tapered where threaded into the shell. The booster charge and method of assembly are identical with those of common steel shell, except that the fuze socket holder is held by a bushing threaded into the adapter collar. This bushing is threaded on the inside to take the thread on the French fuzes.

POINT DETONATING FUZE I. A. L., MARK III.

(Plate VII.)

This fuze is designed to burst the shell before it can enter the ground. "I. A. L." signifies *Instante Allongé Lefevre*, or the instantaneous, elongated fuze of Lefevre design. Its principal parts are: The body, the cap, the firing pin, firing-pin head, supporting washer, half rings, spiral, safety pin, percussion primer, upper detonator, and lower detonator.

The action of the fuze is as follows: The rotation of the projectile causes the spiral to unwind, due to centrifugal force acting on the weighted end. When the spiral flies off, the half rings accompany it. This arms the fuze by permitting the backward thrust of the pin on impact to fall directly on the safety pin. When the pin is bent the firing pin impinges on the percussion primer. The explosion of the primer in turn explodes the upper detonator. The flame from the upper detonator reaches the lower detonator, through the channel, exploding it and detonating the booster charge in the booster casing. These explosions follow in such rapid succession as to make the bursting of the shell practically simultaneous with the first impact of the firing-pin head.

POINT DETONATING FUZE, MARK V.

(Plate VIII.)

This fuze is designed so that a slight change in its components in assembling makes it either a long or short delay action, or a non-delay action fuze. A double arming feature distinguishes this fuze from other types.

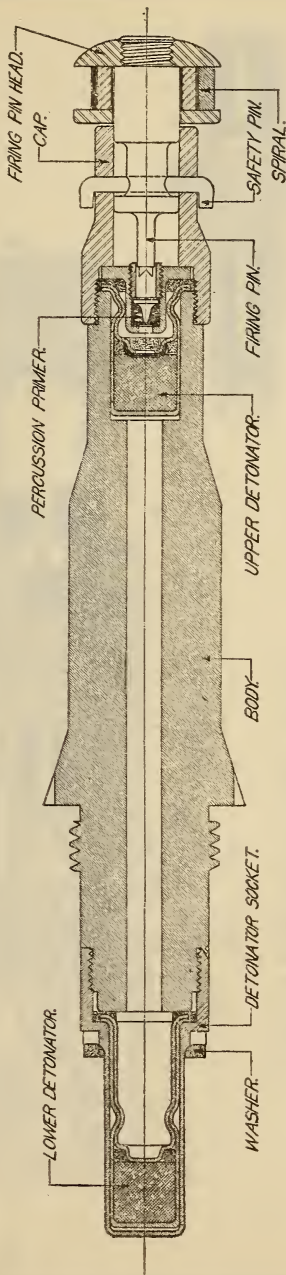
The principal parts are: Fuze body (D), detonator (M), closing cap (A), firing pin (Z), head safety support (F'), head safety spring (F), head plunger (C), head plunger casing (B), relay cup (Q), percussion plunger (W), percussion primer (Y), delay retard carrier (H), safety casing (U'), arming casing (B'), arming spring (D').

In action, the head plunger (C), through its inertia, at the impulse of the propelling charge, compresses the spring (F) and engages the points of the casing (E) with the head safety support (F'), locking them. The head plunger and head safety support are now free from pressure of the spring (F), and can either creep forward or move forward on impact so that the firing pin is exposed and the fuze armed. The arming casing (B'), at the impulse of discharge, parallels the action of the head plunger above described by pushing back the arming spring (D').

The sides of the arming casing (B'), disengage the prongs of the safety casing (U'), freeing the percussion plunger (W) for forward movement, while the prongs of the arming casing engage the collar on the side of the percussion plunger (W). The arming casing is thus held back exposing the percussion primer and completing the arming of the fuze. At impact, the percussion plunger (W) goes forward and is exploded by the firing pin (Z), the compressed black powder in the firing pin plug (A') ignites, the flames being communicated to the uncompressed black powder in the percussion plunger (X). This in turn ignites the delay charge in the delay retard carrier (H) which consists of Army black powder compressed to about 42,000 pounds to the square inch. The length of delay depends on the length of this compressed powder to be burned. The long delay is, approximately, 0.15 of a second; the short delay about 0.05 of a second. When the flame of the delay train reaches the quick match, it ignites the slightly faster burning powder in the relay cup (R), which explodes the 30 grains of fulminate of mercury in the detonator. This detonates the booster charge in the adapter and explodes the shell.

For nondelay action the amount of compressed black powder in the percussion plunger is lengthened and the delay charge and quick match removed. This permits the flame to flash directly to the charge in the relay cup and to cause the explosion of the detonator as before.

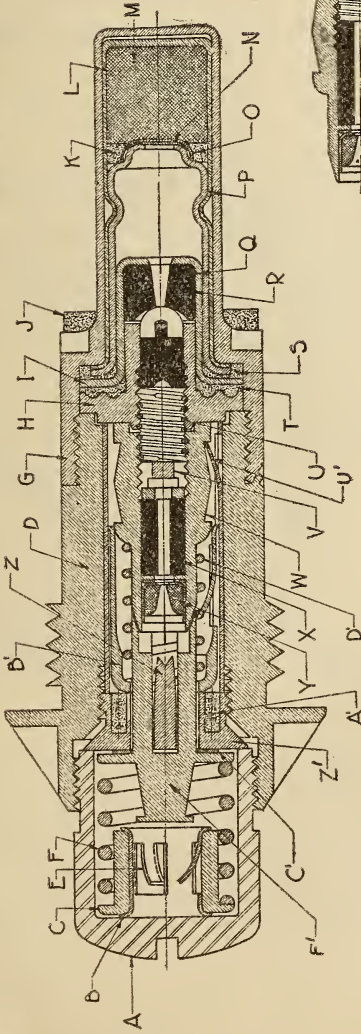
This latter action, while not used in the Mark V fuze, is utilized to create a Mark IV fuze similar to the Mark V and with which the artilleryman should be familiar. This fuze is a nondelay Mark V without the head arming feature. It arms at lower muzzle velocity than Mark V.



DETONATING FUZE - MARK - III.

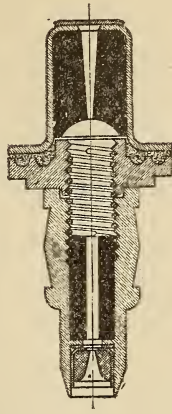
35-23-11A

PLATE VIII



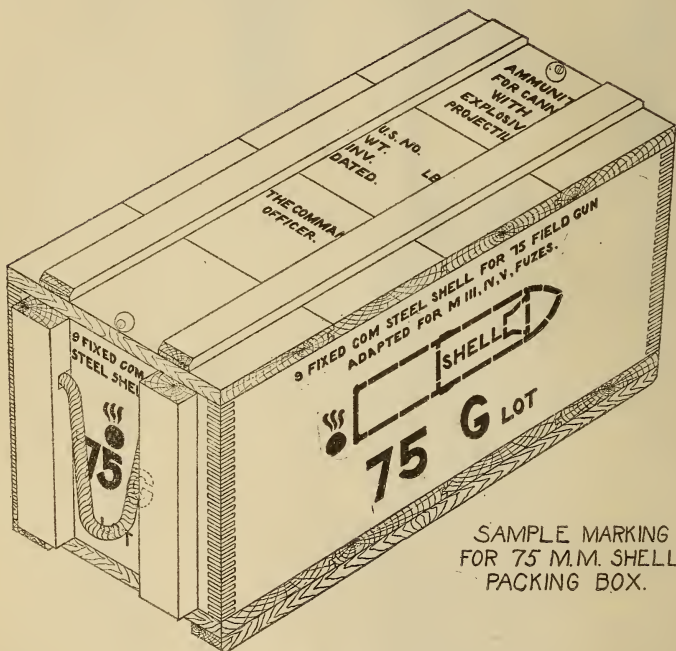
FUZE-LONG AND SHORT DELAY.

POINT DETONATING FUZE
MARK V



FUZE-NON-DELAY.

PLATE IX



SAMPLE MARKING
FOR 75 M.M. SHELL
PACKING BOX.

IDENTIFYING PAINT MARKS ON DELAY ACTION FUZES.

Distinguishing colors indicate the delay action of the fuzes used in 4.7-inch projectile as follows: Long delay Mark V fuzes have the head closing cap painted black, and the detonator socket painted violet. Short delay Mark V fuzes have the black head cap only. Nondelay action in Mark IV fuzes is indicated by the fact that the head closing plug is white.

MARKING ON AMMUNITION PACKING BOXES.

For quick and accurate identification, the 4.7-inch ammunition packing box is marked on top, on both sides and on both ends, as shown in Plate IX.

Plate IX.

The symbol marking identifies the type of ammunition instantly; when familiarized, the smaller, more explicit marking is a check and teaches the significance of the symbols, also giving quantities. Black only is the color used in marking these boxes. The marking follows a fixed system. The 75-mm. marking is shown here. By substituting 4.7 for 75 the same marking covers the 4.7-inch gun, as both use fixed ammunition.

The type of cartridge or projectile shown to the right of the ordnance escutcheon (side view) is always representative of the kind contained, whether separate loading, fuzed, or unfuzed, etc. The size of the piece, whether in inches or millimeters, always appears in the same place, as does also the lettering indicating (G in this case) whether ammunition is for gun, howitzer, anti-aircraft gun, etc. The lot number follows the word "Lot" and should always be referred to in the reports concerning the failure of ammunition to function properly.

Practically the same marking appears on the ends with the exception of a representation of the round of ammunition. The place of packing and the ordnance inspector's stamp are always placed on the upper left-hand corner of the top. Following downward, is the United States number of the individual box and the total weight of the box, together with the proper invoice number, and the date of invoice. Boxes in any invoice are numbered from No. 1 up to the total number of boxes the invoice contains. Finally, the destination for shipment is given.

MARKING ON FUZE PACKING BOXES.

High-explosive shell requiring a booster can not safely be shipped, fuzed. Special packing boxes are provided for each type of fuze. They are marked on the top, sides, and both ends. The marking follows a fixed system similar to that used on ammunition boxes.

Ordnance inspector's stamp and place of packing appear on left top corner of case. The sentence, "Detonating fuzes; handle carefully," appears next to conform with interstate commerce requirements. The United States number, weight, number of invoice and date follow in order. Boxes in any invoice are numbered from No. 1

to the total number of boxes the invoice contains, for reference. The destination completes the marking of the top. The side marking consists of one line giving quantity, whether base or point detonating, and the mark or number by which the fuze is known. Under this line is given length of delay—whether non, short, or long delay—and the lot number, to be used in reporting all cases of nonfunctioning fuzes. Underneath is shown the ordnance escutcheon. This marking is repeated on a smaller scale on both ends of the box.

WEIGHT MARKINGS ON SHELL.

So that variations in weight of loaded shell can be allowed for in computing firing data, 4.7 shells are classified by weight into three zones. These zones are indicated by punch marks, as follows:

	Marks.
43 pounds up to and including 43 pounds 11 ounces.....	1
43 pounds 11 ounces up to and including 44 pounds 6 ounces...	2
44 pounds 6 ounces up to and including 45 pounds 1 ounce.....	3

The marks are placed about 0.5 inch in rear of the bourrelet and spaced 0.5 inch apart. They should average about 0.1 inch in diameter and are punched deep enough to be felt and counted by sense of touch, enabling artillerymen to recognize weight of projectiles during night firing. Each punch mark has a square of black paint stenciled over it for identifying weight zones by sight.

Weight zones indicated by the marks are for shell containing bursting charge, adapter and booster charge, but without fuze. Mark III fuzes add 15 ounces to the shell's loaded weight. Mark V fuzes add 6 ounces. Shrapnel varies but 1 per cent in weight and has no weight zones.

SUBCALIBER AND DRILL CARTRIDGE KIT.

The subcaliber and drill cartridge kit consists of:

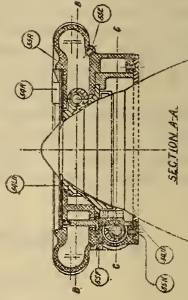
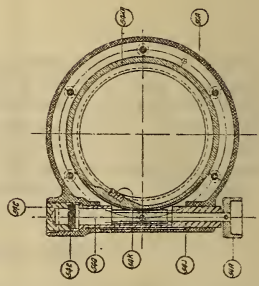
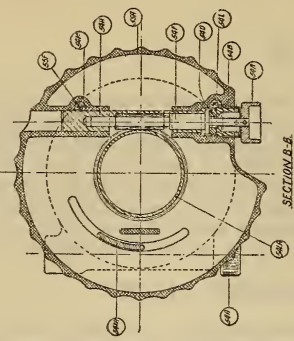
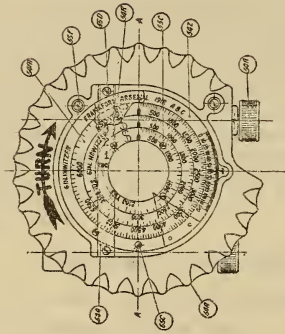
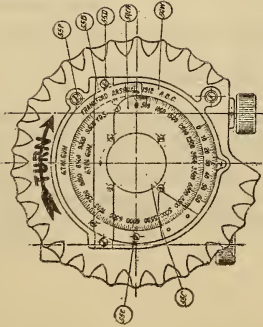
3 drill cartridges, 1 extra base.	1 bristle cleaning brush.
1 subcaliber cartridge, 1 extra base.	1 pin wrench.
2 ejector springs.	1 storage chest.
2 ejector spring screws.	6 rotating pins.
1 cleaning rod.	1 graduated ring with felt washer.
1 eyepiece.	4 ring screws.
1 extension piece.	2 closing cap set screws.
	6 stop pins.

One subcaliber and drill cartridge kit is issued for each gun.

ALLOWANCE OF AMMUNITION.

Shell and shrapnel ammunition is issued by the Ordnance Department in boxes containing 2 rounds each. The allowance of ammunition for the instruction of field artillery is prescribed from time to time in War Department orders. These orders give full information as to the allowance of fixed, subcaliber, or other ammunition for 4.7-inch guns, also drill cartridges and revolvers with instructions for their care.

PLATE X



HAND FUZE SETTER

CARE OF CARTRIDGE CASES.

As soon after firing as practicable the fired primers should be removed from the cartridge case by means of the decapping tool furnished with the reloading outfit. The case should be thoroughly washed in a strong solution of lye or soft soap to remove all powder residue. It should then be thoroughly rinsed and dried and lightly oiled. If the cartridge cases are carefully cleaned and washed immediately after firing, not only will less labor be required but the life of the cases will be greatly prolonged.

A good solution for washing cartridge cases may be prepared by using ingredients in the following proportions: 1 gallon of water, 2½ ounces soft soap, 5½ ounces soda.

The mixture should be boiled and stirred until the ingredients are entirely dissolved. In washing cartridge cases this solution should be used hot and in sufficient quantity to completely immerse the cases.

Primers that misfire should be returned with the cases to the ordnance establishment prescribed in the target-practice order.

RESIZING OF CARTRIDGE CASES.

The resizing of 4.7-inch cartridge cases that have become deformed in service is done at designated ordnance establishments.

RANGE TABLES.

Owing to the necessity for range tables for different weights of projectile it is impracticable to include them in the handbook. Complete range tables for the 4.7-inch gun will be issued separately, covering 60-pound projectiles, 45-pound shell, and giving time of burning of 31 and 45 second combination fuzes.

THE HAND-FUZE SETTER, MODEL OF 1913.

(Plate X.)

The hand-fuze setter provided for the 4.7-inch gun consists principally of an aluminum case having a serrated rim forming a handle for turning; a range ring which has graduations for the 31-second fuze on one side, and graduations for the 45-second fuze on the reverse side and is mounted on the range-ring carrier, which is operated by the knob on the range worm. A corrector scale mounted on the corrector-scale support, which is operated by the knob on the corrector worm, and a guide plate which rests on the projectile.

A slot is cut in the range-ring carrier, which engages with the pin on the graduated time train ring of the fuze. A stop pin is attached to the corrector-scale support and engages with the stop pin body of the fuze to limit the motion of the fuze setter. The range-worm and corrector worm are mounted eccentrically in the range-worm case and the corrector-worm case. Upon rotation this provides an ad-

justment to accommodate slight variations in machine operations and to take up for wear between the teeth of the worms and gears.

The range-worm adjusting screw and the corrector-worm adjusting screw have fiber washers fitted in the end, which bear on the collar of the range and corrector worms for taking up the end motion and to provide sufficient friction to resist accidental turning. Clamp plugs are provided for locking the range and corrector worm cases and the range worm and corrector-worm adjusting screws.

OPERATION.

Bring the number of meters of range desired to register with the datum line by turning the range worm till the proper index of the range and the datum line coincide.

Turn the knob of the corrector worm until the index on the case registers with the line on the corrector scale, which indicates the desired correction for height of burst.

To set a fuze, remove the water-proof cap and safety wire. Place the hand fuze setter over the fuze and turn until the slot in the range ring carrier engages with the pin on the graduated time train ring of the fuze. The base plate and the upper part of the range ring carrier will then bear firmly on the projectile. Then turn the fuze setter in a clockwise direction as indicated by the arrow on the top of the case until the stop pin on the corrector scale support engages with the stop pin on the fuze and further motion is prevented.

An index to register with a line on the fuze to indicate when the stop pin on the fuze and fuze setter are in contact is attached to the corrector scale.

ADAPTABILITY TO OTHER GUNS.

This fuze setter is adaptable to all projectiles using the 31-second and 45-second combination fuzes by using suitable range ring corrector scale, guide plate, and index bar. The corrector scale for guns has 60 graduations, 30 being the normal position. The guide plates are suitably marked for the projectile to which they are fitted. The range rings and corrector scales are marked with the name of the gun.

4.7-INCH GUN DRILL CARTRIDGE.

The drill cartridge is a dummy cartridge for use in drilling cannoneers in the service of the gun. The principal parts are: Wood body, bronze base, body guard, stop pin, graduated ring, point nut, and bolt extending through entire length. It is the shape of the service shrapnel ammunition, and is fitted at the point with a movable ring graduated the same as the ring upon the Frankford Arsenal combination fuze. This arrangement is for the instruction of cannoneers in fuze setting.

THE RELOADING AND CLEANING OUTFIT.

This outfit consists of the following parts and is furnished each battery and to each post where a saluting gun is kept:

Primer inserting press, large.	} Class V, section 5.
Bushing.	
Powder measure, saluting.	
Decapping tool, with guide.	
Cleaning brush.	
Hammer.	
Case holder.	
Case holder stand.	
Storage chest.	

The bushing is used in the primer inserting press for the insertion of new primers. The decapping tool and case holder and stand are used for removing exploded primers from the cartridge cases. A light blow on the rod with a piece of wood or the bronze hammer generally removes the primer.

A powder measure to suit the saluting charge for the gun is furnished, and when level full holds the required charge. The cleaning brush is furnished for cleaning the cartridge cases after they have been used and should be ordered to suit the size of the case for which intended.

MISFIRES AND HANGFIRES.

“Misfires” and “hangfires” are of exceedingly rare occurrence with this ammunition. In case of the failure of the cartridge to fire when the trigger is pulled, the breechblock *should not be opened* until after the expiration of at least one minute. The gun may be immediately recocked without opening the breech mechanism and the cartridge tried again. Defective cartridges should be reported to the armament officer.

THE 4.7-INCH GUN CARRIAGE, MODEL OF 1906.

WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

Weight of carriage, complete.....	pounds..	5, 320
Weight of gun and carriage, complete.....	do....	8, 068
Weight of gun and carriage on limber, gun in battery.....	do....	312
Weight of gun and carriage on limber, gun in traveling position.....	pounds..	1, 282
Diameter of wheel.....	inches..	61
Width of wheel (rubber tired).....	do....	6
Length of recoil of gun on carriage.....	do....	70
Height of axis on gun.....	do....	51. 59
Height of line of sight.....	do....	53. 92
Length of sight radius.....	do....	36. 75
Maximum angle of elevation (gun on carriage).....	degrees..	15
Maximum angle of depression (gun on carriage).....	do....	5
Amount of traverse of gun on carriage.....	milliemes..	140
Free height of spring column.....	feet..	12. 5

NOMENCLATURE OF PARTS.

[Details marked * apply to carriages with serial numbers 1 to 40, inclusive, only.
 Details marked † apply to carriages with serial numbers above 40 only.]

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Cradle, complete, including:		IV	3
1	Cradle, including—			
1	Cradle band, front....	Front connections for cylinders..		
1	Cradle band, rear.....	Rear connections for cylinders...		
1	Trunnion band.....	Pivots cradle in pintle yoke.....		
1	Spring cylinder, right.	.....	
1	Spring cylinder, left....	.....	
1	Spring cylinder, rein-	On rear end of spring cylinder,		
	force, right.	right.		
1	Spring cylinder, rein-	On rear end of spring cylinder,		
	force, left.	left.		
1	Spring cylinder head,	In rear end of spring cylinder,		
	right.	right.		
1	Spring cylinder head,	In rear end of spring cylinder,		
	left.	left.		
2	Cradle rails, 1 right, 1	Riveted to bands and spring		
	left.	cylinders.		
2	Cradle rail liner, top,	Riveted to cradle rails at top....		
	1 right, 1 left.			
2	Cradle rail liner, bot-	Riveted to cradle rails at bottom.		
	tom, 1 right, 1 left.			
1	Recoil cylinder lock,			
	complete, includ-			
	ing—			
1	Lock bracket.....	Riveted to cradle band, front....		
1	Lock catch.....	Pinned to bracket.....		
1	Lock pin.....	.....	
1	0.125 by 1.5 split	.....	
	pin.			
†6	Swing bolt forks.....	Riveted to spring cylinders at		
		front.		
1	Shoulder guard	Riveted to spring cylinder re-		
	bracket.	inforce, left.		
1	Guide bracket.....	Riveted to spring cylinder, right.		
1	Guide.....	Riveted to guide bracket.....		
1	Firing handle bracket.	Riveted to spring cylinder re-		
		inforce, right.		
1	Firing handle bracket	Riveted to firing handle bracket.		
	reinforce.			
1	Front sight bracket	} Riveted to spring cylinder, left..		
	support.			
1	Rear sight bracket	} Riveted to spring cylinder, right.		
	support.			
1	Range quadrant fas-	Riveted to spring cylinder, right.		
	tening.			
*1	Elevating bevel gear	Shrunk on cradle band, rear....		
	stop.			
*4	Cylinder cover hinges.	Riveted to spring cylinders at		
		front.		
†1	Spring cylinder cover.....	Bolted to front end of cylinders..		
†6	Swing bolts with pins and	.....	
	split pins.	.....	

Nomenclature of parts—Continued.

No.	Name of part,	Location, etc.	Property classification.	
			Class.	Section.
	Cradle, complete, including— Continued.			
†1	Extension rail pin.....	Pins rail to spring cylinder cover.	IV	3
†1	Shoulder guard pin.....	.....	
†1	Shoulder guard.....	Pinned to bracket on spring cylinder, left.		
†1	Recoil indicator.....	Slides in guide on spring cylinder, right.		
†2	Extension rail plunger....	Secures rail to cover.....		
†2	Extension rail plunger ring.	.....	
†2	Extension rail plunger spring.	.....	
1	Extension rail, complete, including—			
†1	Extension rail body..	Secured to spring cylinder cover.		
2	Extension rail liners, 1 right, 1 left.	Riveted to rail body.....		
†2	Extension rail bearing plates, 1 right, 1 left.	Riveted to outside of rail body..		
†1	Extension rail top plate.	Riveted to rail body.....		
†1	Extension rail diaphragm.	Riveted in rear end of body....		
†1	Latch base.....	Riveted to bottom of rail.....		
†1	Latch plunger.....	In latch base.....		
†1	Latch spring.....	.....	
†1	Plunger ring.....	.....	
*2	Extension rail bolts and nuts.	Secure rail to cradle band, front.		
*2	Extension rail bolt pins.	Secure bolts to rail bracket.....		
*1	Extension rail body..	Bolted to cradle band, front.....		
*2	Extension rail bearings, 1 right, 1 left.	Riveted to sides of body.....		
*1	Extension rail separator.	.....	
*1	Extension rail separator rivet.	.....	
*1	Extension rail bracket	Riveted to rear end of body.....		
†1	Extension rail latch socket.	Riveted to spring cylinders.....		
*1	Extension rail pin.....	Secures cylinder cover and rail..		
*2	Spring cylinder covers....	Pinned to front ends of cylinders.		
1	Dust guard.....	On extension rail between clips on gun.		
2	Dust guard pads.....	Pinned to dust guard.....		
3	Button head cap screws..	Secure dust guard.....		
1	Recoil indicator throw...	Pinned to dust guard.....		
2	Recoil indicator throw pins.	.....	

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Cradle, complete, including— Continued.			
1	Recoil and counterrecoil arrangement, including—			
1	Recoil cylinder, complete, including—			
1	Recoil cylinder...	In cradle bands between spring cylinders.		
1	Cylinder head....	On front end of recoil cylinder...		
2	Cylinder gaskets..	Oil-tight seat for cylinder head..		
1	Stuffing box.....	On rear end of recoil cylinder....		
1	Stuffing box gland	In end of stuffing box.....		
5	Rings, Garlock hydraulic waterproof packing.	.....	
†3	Filling and drain plugs.	In cylinder head and stuffing box.		
†3	Gaskets.....	Under plugs.....		
*2	Filling and drain plugs.	In cylinder head and stuffing box.		
*2	Gaskets.....	Under filling and drain plugs....		
1	Piston rod.....	In cylinder.....		
1	Piston.....	On front end of piston rod.....		
1	Piston rod nut.....	Secures rod to gun lug and spring rod yoke.		
1	Counterrecoil buffer..	In front end of piston rod.....		
1	Counterrecoil buffer nut.	Secures buffer to cylinder head..		
6	Outer counterrecoil springs.	Assembled in spring cylinders...		
6	Middle counterrecoil springs.	In spring stirrups, outer.....	IV	3
6	Inner counterrecoil springs.	In spring stirrups, inner.....		
2	Spring stirrups, outer.	Connect outer and middle springs		
2	Spring stirrups, inner.	Connect middle and inner springs		
2	Spring stirrup flanges, outer.	On front end of spring stirrup, outer.		
2	Spring stirrup flanges, inner.	On front end of spring stirrup, inner.		
2	Spring stirrup heads, outer.	On rear end of spring stirrup, outer.		
2	Spring stirrup heads, inner.	On rear end of spring stirrup, inner.		
*2	Outer stirrup reinforcements, front.	Secures flange to spring stirrup, outer.		
*2	Outer stirrup reinforcements, rear.	Secures head to spring stirrup, outer.		
*2	Inner stirrup reinforcements, front.	Secures flange to spring stirrup, inner.		
*2	Inner stirrup reinforcements, rear.	Secures head to spring stirrup, inner.		
4	Spring separators, outer.	Between outer springs.....		

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Cradle, complete, including— Continued.			
	Recoil and counterrecoil arrangement, including—Continued.			
4	Spring separators, intermediate.	Between middle springs.....	IV	3
4	Spring separators, inner.	Between inner springs.....		
2	Spring rods.....	In inner springs.....		
2	Spring rod flanges.....	On front ends of rods.....		
2	Spring rod plugs and nuts.	On rear ends of rods.....		
2	Spring rod keys.....	Seated in plugs.....		
1	Spring rod yoke.....	Connects spring rods and gun.....		
1	Firing mechanism, complete, including—			
1	Firing shaft.....	Assembled in firing handle bracket.		
1	Firing handle.....	On shaft.....		
1	Shaft trip collar.....	do.....		
1	Shaft retaining collar.....	do.....		
1	Trip collar pin.....	do.....		
1	Shaft return spring.....	In firing handle bracket.....		
1	Handle return spring.....	do.....		
1	Trip latch plunger.....	In firing handle.....		
1	Trip latch.....	On end of plunger.....		
1	Trip latch pin.....	Pins plunger in latch.....		
1	Trip latch spring.....	do.....		
1	Adjusting screw.....	In firing handle bracket.....		
1	Pintle yoke, complete, including—			
1	Pintle yoke, with 4 handy oilers.	Supports the gun at the trunnion band.		
2	Trunnion bearing liners with 6 screws.	.....	
3	Bolts and nuts.....	Secure pintle yoke to traversing bracket.		
2	Trunnion caps, with pins and handy oilers.	Cap over trunnions.....		
2	Trunnion cap bolts.....	.....	
1	Pintle bearing, complete, including—			
1	Pintle bearing.....	On axle between axle bearings..		
1	Pintle bearing liner.....	In pintle.....		
4	Bolts and nuts.....	Secure pintle bearing to trail....		
1	Trail tie bolt and nut.....	do.....		
1	Axle.....	.....	
1	Trail, complete, including—			
2	Flasks, 1 right, 1 left.....	Form sides of trail.....		
2	Axle bearings, 1 right, 1 left.	Riveted to front end of flasks....		
2	Axle bearing bolts and nuts.	Clamp bearings to axle.....		
1	Traversing transom, front.	First, in trail, riveted to flasks..		

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Trail, complete, including— Continued.			
1	Traversing transom liner, front.	Bearing surface on traversing transom, front.	IV	3
1	Traversing transom, rear.	Second, in trail, riveted to flasks.		
1	Traversing transom liner, rear.	Bearing surface on traversing transom bracket.		
1	Traversing transom bracket.	On traversing transom, rear.....		
1	Tool box front transom...	Third, in trail, riveted to flasks.		
1	Tool box rear transom...	Fourth, in trail.....		
1	Tool box top plate.....	Riveted to flasks and transom..		
*1	Fastener (female) (for extension rail carrier).	Riveted to tool box rear transom.		
*1	Hinge (for extension rail carrier).	Riveted to trail cover plate.....		
1	Tool box cover plate.....	Hinged to tool box top plate....		
1	Name plate.....	On tool box top plate.....		
1	Tool box bottom plate....	Forms floor of tool box.....		
*3	Tool box, bottom hole, cover.	Riveted to tool box bottom plate.		
1	Trail cover plate.....	Top of lower trail.....		
1	Cover plate front liner.....	Reinforce trail cover plate at traveling lock.		
1	Cover plate rear liner.....			
1	Trail end reinforce plate..	Inside lower trail.....		
2	Spade brackets, 1 right, 1 left.	Riveted to flasks and trail cover plate.		
1	Spade key bracket.....	Riveted to lower end of trail....		
2	Seat supports, 1 right, 1 left.	Riveted to flasks.....		
2	Seats.....	On supports at side of trail.....		
4	Cover hinges.....	On cover plates.....		
1	Tool box fastening, complete, includes—			
2	Clips.....	On tool box cover plate.....		
2	Eyes.....	Riveted to transom.....		
3	Stops.....			
1	Handle.....			
1	Lock eye.....	Riveted to tool box rear transom.		
1	Chain rivet.....	On trail cover plate.....		
1	Yale lock, No. 840, with bolt snap and chain.			
1	Traveling lock cover fastener, complete.			
1	Traveling lock cover plate.	Hinged to trail cover plate.....		
1	Chain rivet.....	Riveted to traveling lock cover plate.		
1	Traveling lock cover pin..	Fastens traveling lock cover plate.		
1	Traveling lock cover chain.	Secures the pin.....		
1	Sponge stop.....	On right flask.....		
1	Sponge staff fastening.....			
1	Sponge staff hasp.....			
1	Hinge pin.....	On right flask of trail.....		
1	Bolt with 0.135 twist coil chain and ring.			

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Trail, complete, including—			
	Continued.			
1	Sponge staff double fastening.	} On left side of trail.....		
1	Sponge staff double hasp.			
1	Hinge pin.....			
1	Bolt with 0.135 twist coil chain and ring.			
1	Sponge staff socket.....	On right side.....		
1	Bar and sponge staff socket.	On left side.....		
2	Liners (wheel guards).....	On sponge staff sockets.....		
2	Liner screws (wheel guard).....			
1	Maneuvering bar support.	Riveted to left flask.....		
2	Maneuvering bar support pins.			
1	Fastening lever.....	Pinned in support.....		
1	Fastening lever pin.....	Secures spring.....		
1	Fastening spring.....	Pinned in lever.....		
1	Maneuvering bar stop.....	Riveted to left flask.....		
4	Trail handles, 2 short, 2 long.	Riveted to flasks.....		
2	Trail prop brackets, 1 right, 1 left.	.....do.....		
2	Trail prop stops, 1 right, 1 left.	Riveted to bottom flange of left flask.		
1	Prop chain bracket.....	Riveted to bottom flanges flask.		
1	Prop hook button.....	On right flask.....		
1	Azimuth scale bracket.....	Riveted to left flask.....		
1	Azimuth scale strip.....	On bracket.....	IV	3
1	Traveling lock, complete, including—			
1	Traveling lock frame..	Riveted to flasks.....		
2	Traveling lock legs.....	Hinged in traveling lock frame..		
2	Lock pins.....			
1	Leg prop.....	Supports one traveling lock leg..		
1	Lock bolt.....	Secures gun to traveling lock.....		
1	Lock bolt sleeve.....			
1	Lock bolt nut.....			
1	Lunette transom.....	Riveted to lower ends of flasks..		
1	Lunette transom bushing.	In lunette transom.....		
2	Lunette transom rivets.....			
2	Lunette trail reinforce, 1 right, 1 left.	Riveted to trail flasks.....		
*1	Elevating and traversing lock lever guide.	Riveted to tool box top plate....		
†1	Elevating and traversing lock lever fastening.	Riveted to left trail flask.....		
1	Spade, complete, including—			
1	Spade frame.....			
*2	Spade braces, 1 right, 1 left.	Interior framework of spade.....		
†1	Float.....	Riveted to spade frame.....		
*2	Floats, 1 right, 1 left.....	.....do.....		

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Spade, complete, including— Continued.			
1	Spade edge.....	Forms point of spade.....		
†2	Spade points.....	Riveted to spade edge and frame.		
*2	Spade braces, 1 right, 1 left.	Riveted to floats.....		
†2	Bearing plates, 1 right, 1 left.	Riveted to floats and frame.....		
*1	Spade plate.....	Riveted to float.....		
1	Spade reinforce.....	Braces spade edge.....		
1	Spade key, complete.....	Locks spades in position.....		
1	Spade pin, with nut.....	Hinges spade to trail.....		
*2	Spade, center bearings, 1 right, 1 left.	Riveted to spade braces.....		
*2	Spade, rear bearings, 1 right, 1 left.	Riveted to spade brace and frame.		
2	Handspikes, complete, including—			
2	Handspike webs, 1 right, 1 left.	Pinned to spade.....		
2	Lower bands.....	.....	
2	Middle bands.....	.....	
2	Tips.....	.....	
4	Handspike bodies, 2 inner, 2 outer.	.....	
1	Chain eye.....	On left handspike body.....		
1	Trail prop, complete, including—			
2	Prop tubes.....	Hinged under trail.....	IV	3
1	Prop foot.....	.....	
2	Prop braces.....	.....	
2	Prop eyes, with pins.....	.....	
1	Trail prop chain, complete, including—			
1	Prop chain.....	.....	
1	Prop hook.....	.....	
1	Prop chain swivel with pin.	.....	
*1	Extension rail carrier, complete, including—			
*1	Bottom plate.....	.....	
*1	Bed.....	Riveted to trail bottom plate.....		
*1	Stop.....	.....	
*1	Hanger pin.....	.....	
*1	Hanger.....	Suspends carrier from hinge.....		
*1	Fastener (male).....	Riveted to trail bottom plate.....		
*1	Pin, including body, spring, head, and rivet.	Hinge pin in fasteners.....		
*1	Chain.....	Secures pin.....		
*2	Chain rings.....	.....	
*1	Catch.....	Secures extension rail to bed.....		
*1	Catch support.....	.....	
*1	Catch spring.....	.....	
*1	Catch pin.....	.....	

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Elevating mechanism, complete, including—			
1	Elevating gear bracket with 2 handy oilers.	Trunnioned in elevating yoke sides.	IV	3
4	Bushings.....	Forced in bracket.....		
*1	Elevating screw cover....	Closes lower end of elevating gear bracket.		
†1	Elevating screw cover with split pin.	.....do.....	
*3	Elevating screw cover springs.	.....	
1	Outer elevating screw....	.....	
1	Inner elevating screw....	.....	
1	Elevating pin.....	Assembles inner screw to rear cradle band.		
2	Elevating yoke sides, 1 right, 1 left.	Bolted to traversing bracket to form frame for elevating mechanism.		
1	Elevating yoke transom with 1 spring cover, No. 1.			
2	Elevating yoke bushings.	In elevating side yokes.....		
10	Bolts and nuts (8 short, 2 long).	.....	
1	Elevating bevel gear with pins.	Assembled in bracket.....		
2	Keys.....	Riveted to elevating bevel gear.....		
1	Elevating bevel gear lug.	.....do.....	
2	Elevating pinion shafts with 2 nuts.	Assembled in bracket.....		
2	Elevating bevel pinions..	Pinned to inner ends of shafts.....		
2	Elevating handwheels, complete, including—			
2	Wheel bodies.....	On outside ends of shafts.....		
2	Counterbalances.....	.....	
†2	Instruction plates.....	.....	
2	Spindles.....	.....	
2	Sleeves.....	.....	
2	Reinforce pieces.....	.....	
2	Hubs.....	.....	
1	Traversing mechanism, complete, including—			
1	Traversing bracket with 1-spring cover, No. 1.	Bolted to pintle yoke.....		
1	Traversing yoke.....	.....	
3	Bolts and nuts, 2 short, 1 long.	.....	
1	Azimuth pointer.....	On traversing bracket.....		
1	Traversing screw bracket.	Bolted to left flask.....		
3	Bolts and nuts, 2 long, 1 short.	.....	
1	Traversing screw bracket cap.	Bolted to bracket.....		
2	Bolts and nuts.....	.....	
1	Traversing screw bearing with 1 handy oiler.	Swivels in traversing screw bracket.		

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Traversing mechanism, complete, including—Contd.			
1	Traversing screw, with 1 nut.	Assembled in bearing and nut.....	IV	3
1	Traversing nut with handy oiler.	Swivels in traversing yoke.....		
1	Traversing handwheel, complete, including—			
1	Wheel body.....	On end of traversing screw.....		
1	Counterbalance.....	.....	
†1	Instruction plate.....	.....	
1	Spindle.....	.....	
1	Sleeve.....	.....	
1	Reinforce piece.....	.....	
1	Hub.....	.....	
1	Elevating and traversing lock, complete, including—			
†2	Lock bar bearing, 1 right, 1 left.	Riveted to trail flasks.....		
†2	Bearing braces, 1 right, 1 left.	.....do.....	
*1	Lock bolt casing.....	Bolted to trail transoms.....		
*4	Bolts and nuts, 2 long, 2 short.	.....	
†1	Lock bar.....	Assembled in lock bar bearings..		
†1	Lock bar lever.....	On lock bar.....		
†1	Lever handle.....	On lock bar lever.....		
†1	Handle bushing.....	In handle.....		
†1	Handle plunger.....	.....	
†1	Plunger spring.....	.....	
*1	Lock bolt.....	In lock bolt casing.....		
*1	Lock bolt end.....	.....	
*1	Link.....	Pinned to lock bolt end.....		
*2	Link pins, 1 long, 1 short.	.....	
*1	Elevating and traversing lock spring.	In lock bolt casing.....		
*1	Lever.....	Pinned to lock bolt casing.....		
*1	Fulcrum pin.....	.....	
1	Band brake mechanism, complete, including—			
2	Brake bands.....	Riveted to brake band ends.....		
2	Brake band ends, lower, 1 right, 1 left.	Pinned to brake cranks.....		
2	Brake band ends, upper, 1 right, 1 left.	Pinned to adjusting bolts sleeve.		
2	Brake band linings.....	Riveted to brake bands.....		
4	Brake cranks.....	On brake shaft.....		
2	Pin type A .610 by 2.125 (A=156).	.....	
2	Brake drums.....	Bolted to wheels.....		
1	Brake lever.....	Hinged to brake shaft.....		
1	Brake lever catch.....	Riveted to brake lever.....		
1	Brake lever hinges.....	On brake shaft.....		
1	Pin type A .734 by 5.3 (A=4.55).	.....	

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Band brake mechanism, complete, including—Contd.			
1	Split pin, 0.25 by 2.75.....	.....	
1	Brake lever sleeve.....	Pinned to brake shaft.....		
1	Split pin, 0.25 by 2.75.....	.....	
1	Brake lever spring.....	Assembled in brake lever hinges.....		
1	Brake lever spring bracket.....	Riveted to brake lever.....		
1	Brake shaft.....	Assembled in brackets.....		
2	Brake shaft brackets, 1 right, 1 left.....	Keyed and clamped to axle.....		
2	0.375 hand oilers.....	On brackets.....		
4	0.75 by 1.46 bolts.....	.....	
4	0.75 by 5.062 bolts.....	Clamp brackets to axle.....		
8	0.75 crown nuts.....	Through brackets and shield.....		
4	Bushings (brake shaft bracket), 2 right, 2 left.....	In brackets.....		
4	Bronze pins 0.125 by 0.687.....	.....	
1	Segment rack (brake).....	Bolted to right brake shaft bracket.....		
2	Adjusting bolt bushings.....	On brake shaft.....		
2	Adjusting bolt eyes.....	On adjusting bolt bushings.....		
2	Adjusting bolt sleeve.....	Screw to adjusting bolt eyes.....		
2	Band clips.....	Bolted to brake shaft brackets.....		
4	0.5 by 0.75 top bolts.....	.....	
4	0.5 lock washers.....	.....	
2	Band guides.....	Riveted to bands.....		
1	Brake shaft washer.....	.....	IV	3
1	Tire brake mechanism, complete, including—			
1	Brake shaft bracket, right, with 1 handy oiler.....	} Keyed to axle.....		
1	Brake shaft bracket, left, with 1 handy oiler.....			
2	Bushings.....	In brackets.....		
4	Bolts and nuts.....	Clamp brackets to axle.....		
4	Bolts and nuts.....	Through brackets and shield.....		
1	Segment rack.....	Bolted to brake shaft bracket, right.....		
8	Bolts and nuts.....	.....	
1	Brake shaft.....	Assembled in brackets.....		
2	Brake cranks and nuts and pins.....	On brake shaft.....		
2	Brake crank washers.....	.....	
1	Brake lever hinge, with pin.....	On brake shaft.....		
1	Brake lever.....	Hinged to brake shaft.....		
1	Brake lever spring bracket.....	} Riveted to brake lever.....		
1	Brake lever catch.....			
1	Brake lever spring.....	Assembled in brake lever hinge.....		
2	Brake beams.....	Hinged to pintle bearing.....		
2	Brake beam hinge pins.....	.....	
2	Brake shoes.....	On ends of brake beams.....		
2	Brake shoe pins.....	.....	

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.		
			Class.	Section.	
	Tire brake mechanism, complete, including—Contd.				
2	Brake rods, complete, including—	Secured to brake beams and brake cranks.	IV	3	
2	Brake rods.....	Equalize pressure on brake shoes.			
2	Brake rod springs.....				
2	Brake spring cover...				
2	Brake rod ends.....				
2	Brake spring cover ends.				
2	Brake rod bushings...				
2	0.25 by 3.5 split pins..				
2	Brake rod pins.....				Secure rod to brake beams.....
2	Brake rod keys.....				Seated in brake rod.....
1	Shield, complete, including—				
1	Top shield, complete, including—				
1	Top shield.....				
2	Top shield braces.....	Lock top shield in either position.			
4	Top shield hinges, upper half, with pins.	Riveted to top shield at bottom..			
2	Top shield fastenings with pins.	Riveted to top shield.....			
1	Shutter, panoramic sight port.	Over panoramic sight port.....			
1	Hinge pin.....	Secures shutter.....			
4	Hinges, sight port shutter.	Riveted to shield and shutter...			
2	Fillers, shutter hinge.				
*1	Shutter latch base....	Riveted to top shield.....			
*1	Shutter latch plunger.	.....		
*1	Shutter latch spring..	.....		
†1	Shutter support.....	Riveted to shutter.....			
1	Main shield, complete, including—				
1	Main shield, right.....	.....		
1	Main shield, left.....	.....		
1	Hood.....	Riveted to main shield.....			
2	Main shield side pieces, 1 right, 1 left.	Bolted to shield.....			
6	Bolts and nuts.....				
2	Main shield braces, upper end.	Braces shield to trail.....			
2	Main shield braces, lower end, 1 right, 1 left.	.....		
2	Main shield brace tubes.	.....		
4	Bolts and nuts, 2 short, 2 long.	Secure shield braces to shield and trail.			
2	Top shield brackets...	Riveted to main shield.....			
2	Top shield brace pins.	Through top shield brace and bracket.			

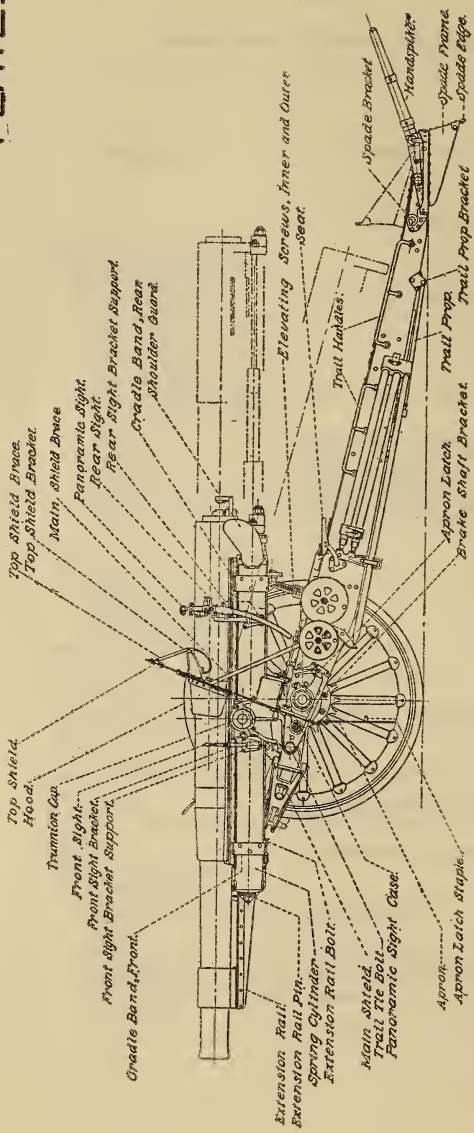
Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Shield, complete, including— Continued.			
2	Main shield, complete, including—Continued.			
2	Top shield brace pin chains, complete, including—			
2	Chains.....	} Fastened to top shield brackets..		
2	End links.....			
2	Rings.....			
4	Top shield hinges, lower half.	} Riveted to main shield.....		
2	Apron hinges, upper half, with pins.			
1	Shutter, peep sight	Over peep sight port.....		
1	Hinge pin.....	.....	
4	Hinges, peep sight port shutter.	Riveted to shield and shutter..		
2	Fillers, shutter hinge.	.....	
1	Shutter latch.....	Riveted to top shield.....		
1	Shutter latch bracket.	.....	
1	Apron, complete, including—			
1	Apron.....	.....	
2	Apron hinges, lower half.	Riveted to apron.....		
2	Apron latch staples..	.....do.....		
2	Apron latches, complete, including—			
2	Apron latch bodies.....	Suspended from brake shaft bracket.	IV	3
2	Apron latch body pins....	.....	
2	Apron latch levers.....	.....	
2	Apron latch lever pins....	.....	
2	Apron latch plungers.....	.....	
2	Apron latch springs.....	.....	
2	Apron latch plunger eyes.	.....	
2	Apron latch plunger eye pins.	.....	
2	Apron latch bushings.....	.....	
2	Wheels, 61-inch, rubber tired, complete, including—			
2	Hub boxes.....	Outer flanges of hubs.....		
2	Hub rings.....	Forced into hub boxes.....		
2	Hub liners.....	Screwed on hub boxes between wheel hook bushing and hub caps.		
2	Hub bands.....	On end of axle.....		
2	Lock washers.....	On outside of hubs.....		
2	Wheel hooks, 1 right, 1 left.	Under wheel hooks.....		
2	Wheel hook bushings.....	On end of hubs.....		
2	Hub caps.....	Actuate hub latch plungers.....		
2	Hub latches, complete....			

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Wheels, 61-inch, rubber tired, complete, including—Con.			
2	Hub latch springs.....	Lock hub caps in place.....		
2	Hub latch plungers.....	Slide in hub caps.....		
2	Wheel oil valves, complete	.....	
2	Oil valve springs.....	.....	
2	Oil valve rivets.....	.....	
2	Oil valve washers.....	.....	
32	Spokes, 16 right, 16 left	.....	
8	Felloe segment, bent, with 16 bolts and washers.	Bolted to felloe bands.....		
2	Felloe bands.....	Bolted to felloe segments.....		
2	Base bands.....	Pressed over felloe bands.....		
2	Tires, rubber.....	On base bands.....		
32	Spoke shoes and rivets.....	Hold spokes to felloes.....		
32	Spoke shoe plates.....	Between spokes and felloes.....		
16	Carriage bolts and nuts.....	Clamp spokes between hub boxes and rings.		
2	Wheel fastenings, complete, including—			
2	Wheel fastenings.....	At ends of axle.....		
2	Wheel fastening plungers.....	.....	
2	Wheel fastening springs.....	.....	
2	Wheel fastening plugs.....	.....	
1	Sight packing, complete.....	In trail tool box.....	IV	3
1	Rear support.....	} Bolted to right flask.....		
1	Front support.....		(for range quadrant case).....	
4	Bolts and nuts.....	For front and rear supports.....		
2	Supports (for panoramic sight case).	1 right, 1 left, bolted to main shield.		
4	Bolts and nuts, 2 long, 2 short.	.....	
1	Range quadrant case, complete.	Pinned to supports.....		
3	Support pins.....	For range quadrant case.....		
1	Panoramic sight case, complete.	Pinned to supports.....		
4	Support pins.....	For panoramic sight case.....		
1	Sighting arrangement, complete, including—			
1	Front sight, complete.....	On sight fastening.....		
1	Sight bracket with shank socket.	On rear support.....		
1	Sight shank.....	In shank socket.....		
1	Range quadrant.....	On quadrant fastening.....		
1	Panoramic sight.....	Fitted to rear sight shank.....		
1	Teat wrench for panoramic sight.	In case.....		

The first part of the book is devoted to a general history of the country, from the earliest times to the present. It is a very interesting and valuable work, and one which every student of history should read. The author has done his duty, and has given us a full and complete account of the country, and of the people who have lived in it. The second part of the book is devoted to a description of the country, and of the various parts of it. It is a very interesting and valuable work, and one which every student of history should read. The author has done his duty, and has given us a full and complete account of the country, and of the people who have lived in it.



4 Inch Gun Carriage *Side Elevation* Model of 1906

Scale: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 inches

For Carriages with Serial Nos. 1 to 40 inc.

DESCRIPTION OF THE CARRIAGE.

[Plates XI, XII, XIII, XIV, XV, XVI, and XVII.]

The 4.7-inch gun carriage, model of 1906, is of the type known as the long recoil in which the gun is permitted a sufficient length of recoil on the carriage to render the latter stationary under firing stresses. A steel casting called a pintle bearing is mounted upon an axle and braced by the trail to form a swivel base for a steel yoke provided with bearings in which the trunnions of the cradle rest. The cradle is a framework, with heavy rails which support the gun, and contains the hydraulic cylinder which controls the gun in recoil and the springs that return the piece to the original firing position. Due to the change from steel to rubber tires there are two types of carriages, the tire brake and the band brake.

For the purpose of description, the carriage may be considered as composed of the following divisions, viz, wheels, axle, trail, and spade, pintle yoke and bearing, cradle, recoil cylinder, counter-recoil spring system, traversing mechanism, elevating mechanism, brake, shield, sights, firing mechanism, recoil indicator, and shoulder guard. The dust guard, actually attached between the front clip and jacket of the gun, is also to be considered as a part of the carriage.

WHEELS.

The wheels are a modified form of the Archibald pattern, 61 inches in diameter, 6-inch face and rubber tired. The hub consists of a steel hub box and hub ring, the two having flanges which clamp the spokes and are drawn together by eight heavy bolts and a ring called a hub band, which is threaded to the hub box. The lock washer and the wheel hook bushing are located on the hub box between the hub band and the hub ring. The wheel hook bushing is assembled under the wheel hook and by means of a flange secures the hook to the wheel. The wheel hook is used for attachment of ropes or chains in emergency traction. The lock washer is located between the wheel hook bushing and the hub band and prevents the latter from unscrewing.

A removable bronze liner is forced into the hub box to form a wearing surface, and the outer end of the hub is closed by a bronze hub cap screwed on the hub box and locked with a small bolt, called the hub latch plunger, which is withdrawn and held in the disengaged position by the hub latch when the cap is to be unscrewed. The hub cap is also fitted with the standard wheel oil valve, which is pulled out to expose the opening for oiling the wheel and closes to render the hub dust proof.

There are 4 bentwood felloe segments held by bolts to the steel felloe bands and to the 16 spokes by the spoke shoe plates, spoke shoes and rivets. The steel base bands, to which the rubber tires are fastened, are pressed on the felloe bands.

The rubber tire and base band form an integral part necessitating the change of the base band as well when a rubber tire needs replacement. This replacement can be made only where there is a hy-

draulic press of sufficient capacity; so that in the field a wheel with a tire unfit for use is replaced by a spare wheel and the entire wheel sent back to a depot for the replacement of the tire.

WHEEL FASTENINGS.

The wheel fastening, a yoke of bronze, fitting recesses in the outer end of the axle arm, secures the wheel to the axle and is exposed when the hub cap is removed. The yoke is secured to the axle arm by the wheel fastening plunger.

AXLE.

The axle is hollow and forged from a single piece of steel. The axle arms will take the standard hubs, being similar to all others in the battery, and the key, solid with the axle, holds the trail axle bearings, brake shaft brackets, and pintle bearing in their proper interrelation.

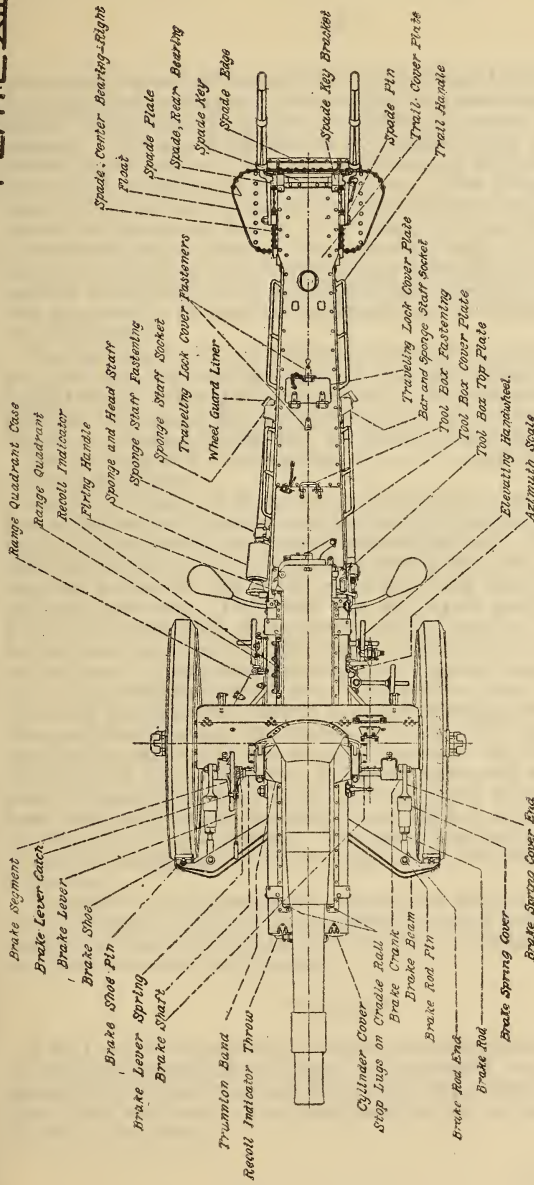
THE TRAIL.

The flasks of the trail are of channel section with the flanges turned inward and are connected by several transoms and braced by riveted plates to form a rigid framework. The forward ends of these flasks extend beyond and surround the axle and are reinforced by cast-steel axle bearings, which are clamped to the axle by bolts. A short distance in rear of the axle are the traversing transom, front, and traversing transom, rear, riveted to the flasks, the first forming a rest for the traversing bracket and the other a seat for the frame of the elevating mechanism. The space between the third and fourth transoms is utilized as a tool box, having a floor and a hinged lid with a shot-bolt handle and padlock. The rest of the trail is covered with a single plate which extends around the lower end and for about 2 feet forward on the underside, and has an opening, with hinged cover for the traveling lock, the frame of which constitutes a fifth transom. The lunette transom, with its renewable bushing bored to receive the pintle of the limber, is riveted about 27 inches from the lower end. A spade bracket reinforces the lower end of each flask, while the spade key bracket braced by the trail end reinforce plate forms the extreme lower end of trail and seat for the spade.

SPADE.

For carriages with serial numbers 1 to 40, inclusive, a spade of the following construction is used:

The spade frame is a plate of flange steel placed crosswise the center line of the trail with wings extending to the front; between these wings and parallel to them, with flanges butting against and riveted to the spade frame, are two braces, whose upper portions extend above the frame and receive steel fittings for attachment to the trail; resting on the wings of the frame and riveted to the spade braces are the floats which meet in rear and with a reinforce called the spade plate form a heavy rail across the top of the spade. The wings of the floats project on either side of the spade to give sufficient bearing in



4.7 Inch Gun Carriage Model of 1906 - Plan.

Scale 0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76 80 84 88 92 96 100 104 108 112 116

For Conversion: 1/16" = 1.5625 mm, 1/8" = 3.125 mm, 1/4" = 6.25 mm, 3/8" = 9.375 mm, 1/2" = 12.5 mm, 5/8" = 15.625 mm, 3/4" = 18.75 mm, 7/8" = 21.875 mm, 1" = 25.4 mm

Inches.

preventing the end of the trail from burying itself in the ground. A hardened steel wearing edge is riveted to the lower edge of the spade frame. In service, when worn or broken, the spade edge may be replaced. The spade reinforce is a V-shaped beam of flange steel riveted to the inside of the spade frame and to the spade braces for the purpose of stiffening the construction. The fittings for attachment to the trail are the center bearings and rear bearings which are riveted to the spade braces. The spade pin passes through the center bearings and the spade brackets of the trail; the rear bearings serve in connection with corresponding bearings in the spade key bracket of the trail and a detachable pin called the spade key, to lock the spade in its position underneath the trail when the carriage is unlimbered.

For traveling the key is removed, the spade is rotated about the pin until the rear bearings coincide with the forward holes of the spade bracket, when the key is inserted to lock the spade in its new position. The spade key and spade pin also secure two handspikes, which are arranged to fold with the spade in limbering.

For carriages with serial numbers above 40 a spade of the following construction is used:

The spade frame is a flange steel plate placed crosswise the center line of the trail with wings extending to the front and riveted to the frame; on its rear and side wings is located the float. Bearing plates, right and left, are riveted to the float parallel with the center line of the trail and to the rear of the frame and form seats for the spade pin and spade key. The spade edge and spade points are riveted to the lower rear edge of the frame, and in service, when worn or broken, may be replaced. The spade reinforce is a T-angle riveted to the inside of the spade frame and the bearing plates for the purpose of stiffening the construction. When unlimbered the spade pin is secured in the forward seats of the spade bearings and rear seats of the spade brackets, and the spade key is secured to the rear seats of the bearing plates and the seats in the spade key bracket. For traveling the key is removed, the spade is rotated about the pin until the spade key seats in the bearing plates coincide with the front holes of the spade brackets, when the key is inserted to lock the spade in its new position. The spade key and spade pin also secure two handspikes, which are arranged to fold with the spade in limbering.

This spade is interchangeable with the one used on carriages with serial numbers 1 to 40 and will be issued in case a spade of the older construction requires replacement, although it will also be necessary to replace the spade key bracket.

TRAIL PROP.

A trail prop for supporting the trail in limbering is hinged in brackets riveted underneath the flasks and arranged to swing forward against the bottom of the trail when not in use, where it is held by a prop chain and hook. Four trail handles, two on either side, are riveted to the flasks.

The attachments for carrying the sponge and the head staff are placed on the right side of the trail, those for the two remaining sections of the staff upon the left. The lower attachments or sockets are used as bases for the wheel guard liners designed to prevent the wheels of the limber from damaging the trail when making short turns. These are to be renewed when worn. Two seats for the cannoneers serving the piece are riveted to brackets, one on either side of the trail.

A name plate giving the name and number of the carriage, model, name of manufacturer, year of completion, and initials of inspector is riveted to the tool box top plate. *In all reports and correspondence the carriage should be designated by the number and model given on the name plate.*

PINTLE BEARING AND YOKE.

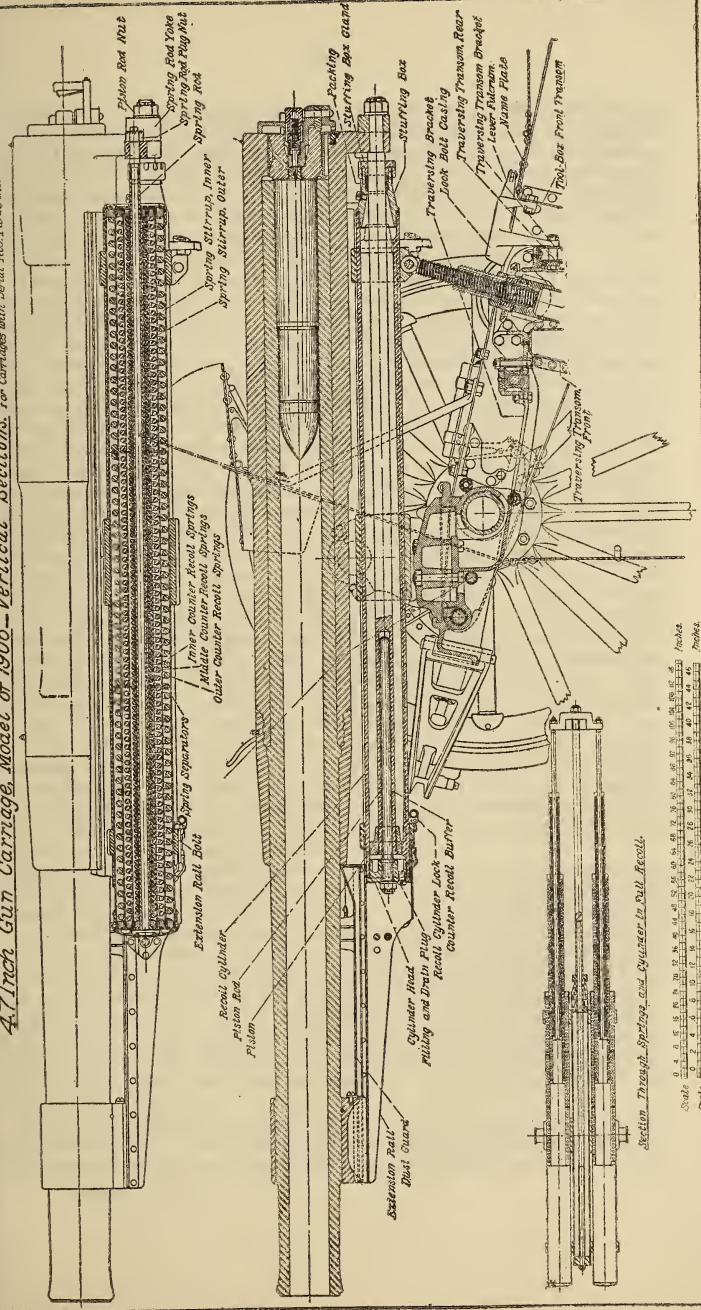
The pintle bearing is a steel casting assembled between the axle bearings of the trail and supported partly by the axle and partly by the bearings to which it is secured by heavy bolts. Two hinge lugs cast upon its forward surface receive the inner ends of the brake beams. It is bored and lined with bronze to form a horizontal tapering seat for the pintle yoke and provided with three clips which engage mating parts on the yoke and firmly secure the two together while allowing rotation of the yoke about a vertical axis. Provision for lubrication of the pintle is made by oil grooves. Two arms on the pintle yoke extend from its base upward and form horizontal bearings for the trunnions of the cradle, having trunnion caps hinged at the rear and fastened with tap bolts in front. Replaceable bronze liners in these bearings receive the weight and wear due to the trunnions.

CRADLE.

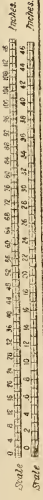
Two parallel steel tubes 7 inches in diameter (spring cylinders), connected by three strong steel bands, are surmounted by heavy steel rails, shaped to fit the clips of the gun and faced with bronze wearing surfaces, to form the cradle. The forward ends of the cradle rails being turned upward form stops against which the locking hoop of the gun strikes in counter recoil, limiting the forward movement of the gun on the cradle.

For carriages with serial numbers 1 to 40, inclusive, the cradle band, front, carries the recoil cylinder lock and also has lugs to receive the swing bolts of a detachable extension of the inner ways of the cradle. This extension rail is of flanged steel formed to shape and built up. It has at its rear end a bracket in which are pivoted the extension rail bolts, and about one-fourth of its length forward of this bracket are the extension rail bearings. The extension rail pin passes through the lugs provided for it on the cylinder covers and the extension rail bearings, forming a front support for the rail. The separator rivet secures the sides of the rail body together. The extension rail is designed as a guide for the front clips of the gun, and is not intended to support weight. For traveling, after the gun has been retracted to its traveling position, the extension rail pin is

4.7 Inch Gun Carriage, Model of 1906. Vertical Sections. For Carriages with Serial Nos. 1 to 40 inc.



Section Through Springs and Cylinder in Full Recoil.



withdrawn (to be replaced later in the extension rail), the swing bolts are loosened, and the extension rail carried back and slipped upon the extension rail carrier, which hangs from suitable fastenings in the rear of the tool box in the rail. The carrier consists of a bottom plate hung by a hook, at its rear end, to the trail cover plate and secured by a pin with a spring catch at the front end, passing through the fastener (male) riveted to the bottom plate and the fastener (female) riveted to the tool box rear transom.

The cradle band, rear, is bored to engage the head of the inner elevating screw and has a boss to admit the point of the elevating and traversing lock bolt. The trunnion band has a threaded seat for the recoil cylinder. The cylinder covers close the front ends of the spring cylinders and act as spring retainers whenever the spring rods are free, and also support the extension rail. Cylinder-cover hinge pins secure the covers to cylinder cover hinges riveted to the spring cylinders. *For carriages with serial numbers above 40* the cradle band, front, carries the recoil cylinder lock only, and the cradle band, rear, is bored to engage the head of the inner elevating screw and also has a lug to engage the elevating and traversing lock bar. The trunnion band has a threaded seat for the recoil cylinder. The cylinder cover closes the front ends of the spring cylinders and acts as a spring retainer whenever the spring rods are free, and also supports the extension rail. Swing bolts pinned to the cover secure it to the swing bolt forks riveted to the spring cylinders. The extension rail is of flange steel formed to shape and built up. It is designed as a guide for the front clips of the gun and for that purpose has bronze liners mounted on its top side. Bearing plates on the sides of the rail at the rear have seats for the extension rail pin and plungers. This pin fastens the rail to the seats on the lower portion of the cylinder cover. In the firing position, two plungers secure the rail to the cylinder cover in line with the main cradle rail. In traveling, after the gun has been retracted to its traveling position, the plungers are withdrawn from their seats in the cylinder cover, allowing the extension rail to swing around the pin. A latch secured to the front end of the rail engages a latch socket riveted to the underside of the cylinders, thus holding the rail out of the way.

For all carriages, regardless of serial number, the rear ends of the spring cylinders are flanged inward and riveted to its bronze heads, against which rest the spring columns. The left cylinder has also a bracket for the shoulder guard and the right cylinder a bracket for the firing mechanism. On the exterior of the left spring cylinder are riveted sight bracket supports for the front and rear sights. On the right spring cylinder are the recoil indicator guide and range quadrant fastening. All of these parts which are riveted together, and including the cylinder covers, cylinder cover hinge pins, or swing bolts and pins, and recoil cylinder lock, are considered integral parts of the cradle and are included in the designation of "one cradle, complete."

The recoil cylinder is a steel tube 77.4 inches long and 4.93 inches outside diameter. Its rear end is closed by a forged-steel stuffing box screwed into the cylinder with a fiber gasket to make an oil-

tight joint, and forming, with a threaded stuffing-box gland, a stuffing-box packed with five rings of Garlock's hydraulic waterproof packing for the piston rod. The cylinder head with a fiber gasket closes the front end. The front end of the cylinder is enlarged to form a flange 5.3 inches in diameter and notched to take a spanner, which also fits a similar flange on the cylinder head. The cylinder should be held by a wrench on this notched flange in assembling or removing the heads; it should never be clamped in a vise or similarly held, as its walls are thin, and while amply strong for the purposes for which intended, may be deformed or flattened by such violent usage. The ribs of the flanges are lashed with copper wire to prevent unscrewing. Both heads have small holes through their walls, closed by filling and drain plugs resting on oil-tight copper gaskets for the purpose indicated in the name of the plugs. *For carriages with serial numbers 1 to 40, inclusive*, the cylinder wall near the front end is provided with three notches to receive the recoil cylinder lock. The notch into which the lock should fall is that which brings the threaded part of the cylinder nearest to being flush with the front of the trunnion band, as this insures proper relation of the piston and throttling bars. *For carriages with serial numbers above 40*, the cylinder wall near the front end is provided with one notch to receive the recoil cylinder lock. The cylinder head forms a socket for the counter recoil buffer, a tapered bronze rod which fits with a small clearance into the piston rod bore when the gun is in battery. The counterrecoil buffer is, for purposes of assembly, a portion of the cylinder head, and is assembled in or removed from the cylinder with the cylinder head. On the interior of the recoil cylinder are machined three longitudinal ribs or throttling bars of uniform width but varying height. Corresponding notches cut in the piston form ports for the passage of the liquid from one side of the piston to the other. The height of the throttling bars along the cylinder determines the area of these ports and is calculated so as to make the resistance which the liquid offers, plus the resistance of the springs, such that the wheels will not jump from the ground when the piece is fired at 0° elevation. This object is accomplished by making at each instant the gravity moment of the system about a horizontal axis through the point of support of the end of the trail greater than the sum of the moments of the piston rod pull and the spring resistance about the same axis. The piston rod is of steel, fitted with a bronze piston rod head screwed on against a shoulder at the front end. The head has three notches cut in its perimeter which fit over the throttling bar projections on the cylinder walls. The front end of the piston rod is bored out for a sufficient depth to take the counterrecoil buffer, which fits into the bore with a very small clearance. In counterrecoil, the oil caught in this bore can escape only by the small clearance mentioned, with the result that the return of the gun into battery is so eased and regulated that all shock and consequent derangement of the aim of the piece is eliminated. The rear end of the piston rod is secured to the recoil lug on the gun and to the spring rod yoke by its nut.

Inside each spring cylinder of the cradle is a column of helical springs of round wire in three sections, called the outer counter-recoil springs, separated by thin washers called spring separators, outer. Within this column is a spring stirrup, outer, with its front end enlarged to retain a spring stirrup flange, outer, which bears against the front end of the outer spring column. The rear end of this spring stirrup, outer, is contracted inwardly to retain a spring stirrup head, outer, another bronze ring against which a second column of helical springs in three sections, called the middle counter-recoil springs, with the intermediate separators, bear. This in turn contains a second tube, the spring stirrup, inner, enlarged outwardly and provided with a bronze spring stirrup flange, inner, at the forward end and turned inwardly with a bronze spring stirrup head, inner, at the rear end, which connects and surrounds a third column of helical springs, also in three sections, called the inner counter-recoil springs, and the inner separators. Lastly, a spring rod, with a bronze spring rod flange resting against a solid collar formed by enlarging the forward end of the rod, passes through the inner springs, the flange bearing against the front end of the spring, the rear end passing through a heavy cross piece behind the lug of the gun, called a spring rod yoke, and fastened to the same by a nut. When the gun with the spring rod yoke and spring rods moves to the rear in recoil the flanges on the front of the spring rods act on the inner coils, the pressure being transmitted to the middle coils by the inner stirrup and to the outer coils by the outer stirrup and resisted by the rear heads of the spring cylinders. In this way the springs work in tandem and have a long stroke with short assembled length. To properly return the gun to battery at high angles of elevation, the springs are assembled with an initial compression of 1,000 pounds on each side.

THE FIRING DEVICE.

The firing device consists of a bracket bolted to the right spring cylinder head, firing handle, handle return spring, shaft return spring, firing handle shaft and pallet, shaft trip collar, shaft retaining collar, adjusting screw, trip latch, trip latch spring, trip latch plunger, and trip collar pin.

The bracket has a cylindrical portion, the cylinder having a central diaphragm or partition. In the rear portion of this cylinder is fitted the shaft return spring which acts on the firing handle shaft—that is, this spring causes the firing handle shaft and pallet to return to their normal position after the sear has been tripped and the gun fired, whether the operator releases the firing handle or not.

The firing handle is mounted loosely on the forward end of the firing handle shaft and pallet and is connected therewith by means of a shaft trip collar and latch. The collar is provided with a squared opening which fits over a correspondingly squared end on the forward end of the firing handle shaft.

The hub of the firing handle is provided with a trip latch so arranged that the latch is engaged in a notch in the periphery of the shaft trip collar.

By this means the firing handle is temporarily attached to the shaft. By a sufficient downward movement of the firing handle the head of the trip latch plunger is caused to come in contact with the end of the adjusting screw located in the firing bracket. This engagement between the adjusting screw and trip latch plunger forces the latter upward, thereby releasing the trip latch and permitting the firing handle shaft and pallet to return to their normal position. Upon the release of the firing handle, the handle return spring restores it to its original position.

On the rear end of the firing handle shaft is formed the firing pallet, which projects far enough to the rear to engage a projection on the lower end of the trigger shaft. The firing pallet is of such length that the gun can be fired when within 2.5 inches of being in battery. By pressing down on the firing handle the following results: The firing handle shaft and pallet are rotated, the shaft return and handle return springs are put under additional tension, the trigger shaft rotates, which in turn rotates the trigger fork, compressing the firing pin spring through the medium of the firing spring sleeve until the front end of the latter trips the sear and releases the firing pin.

ACTION OF THE MECHANISM DURING RECOIL.

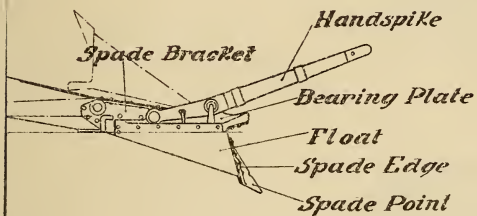
The action of the carriage when the gun is fired is as follows: The gun moves to the rear 70 inches on the cradle ways, carrying with it the piston rod, spring rods, and spring rod yoke and compressing the counterrecoil springs. As the recoil cylinder remains stationary the oil behind the piston must pass to its forward side. The energy of recoil of the gun is absorbed by the resistance which the oil offers to being forced through small openings past the piston and by the resistance of the counterrecoil springs. The energy stored up by the springs returns the gun to its firing position. This return movement is eased and regulated by the counterrecoil buffer. The piston rod pull and spring resistance are transmitted to the carriage, but owing to its weight and the resistance opposed to the trail spade by the earth the carriage remains stationary.

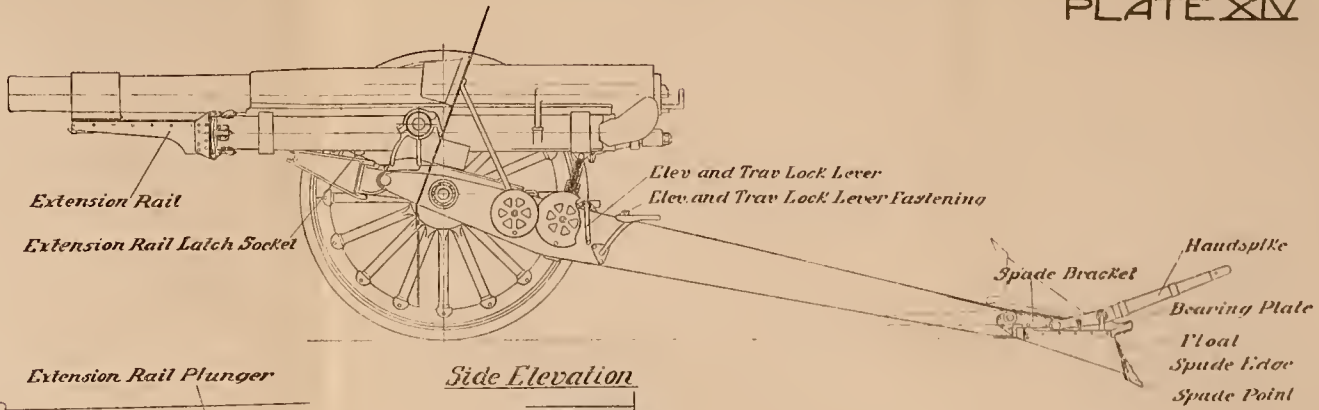
RECOIL INDICATOR AND DUST GUARD.

The length of recoil of the gun upon the carriage is shown by the recoil indicator, a simple friction slide working in the recoil indicator guide, which is mounted upon a bracket riveted to the right spring cylinder in a convenient position for observation. The slide is actuated by the recoil indicator throw attached to a projecting arm of the dust guard with two pins. The bronze dust guard is secured by three button head screws to the gun between the locking hoop and front clip and covers and protects the cradle rails from dust and dirt. It recoils with the gun, and has felt liners or wipers which sweep the cradle rails at each stroke of recoil and counter-recoil.

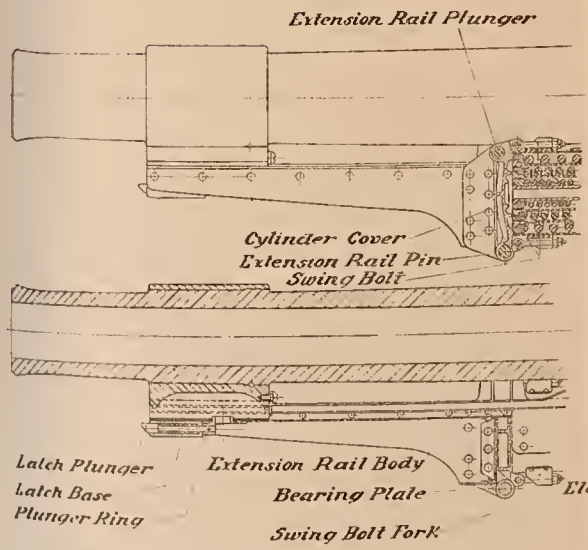
PLATE XIV

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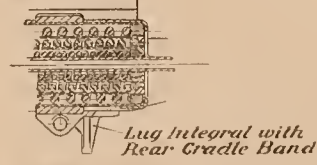




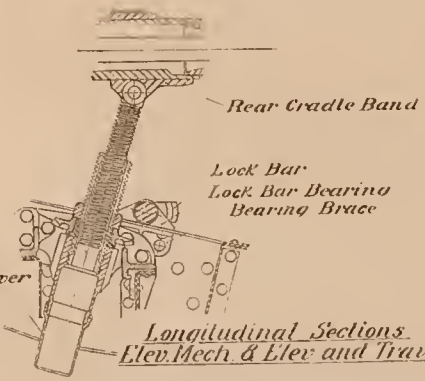
Side Elevation



Longitudinal Sections of Extension Rail



Lug Integral with Rear Cradle Band



Longitudinal Sections
Elev. Mech. & Elev. and Trav. Lock

4.7 Inch Gun Carriage, Model of 1906.
Views of Carriages with Serial Nos. above 40

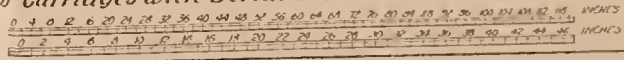
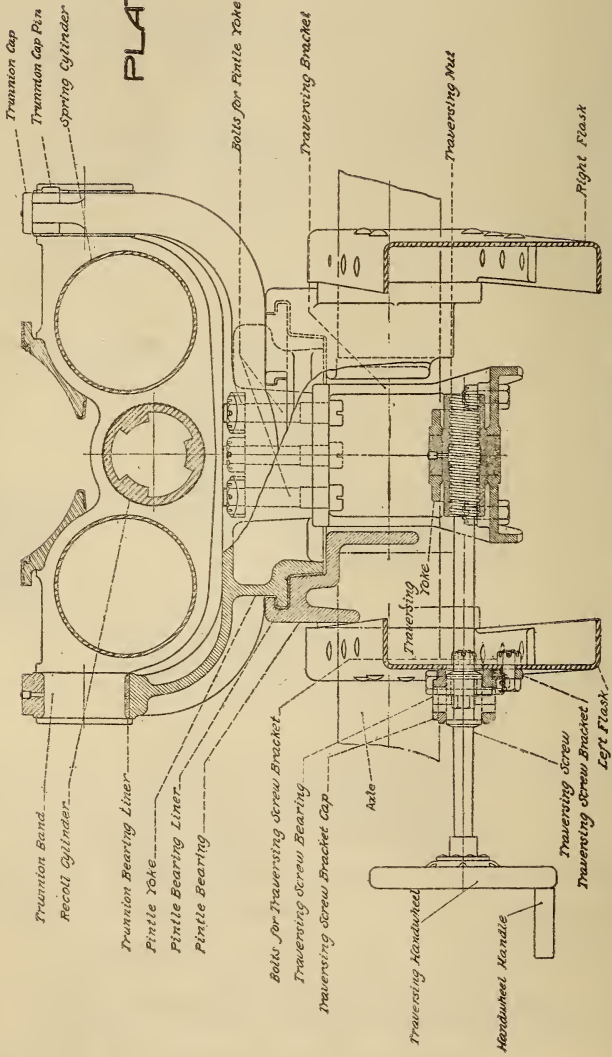


PLATE XXV



Attached to Carriage, Traversing Gear and Pintle Bearing, Vertical Sections. Model of 1906.



TRAVERSING MECHANISM.

The traversing mechanism consists, first, of a bronze traversing nut pivoted on vertical trunnions mounted in the traversing bracket and in a part called the traversing yoke bolted to the traversing bracket; second, a traversing screw with a handwheel mounted in a bearing also swinging on vertical trunnions supported by the traversing screw bracket, with cap, bolted to the left flask of the trail.

The traversing bracket is a steel casting bolted at its rear end to the elevating yoke and at its front end to the under surface of the pintle yoke, the combination rotating as one piece in the pintle bearing.

Longitudinal movement of the screw is prevented by a shoulder on either side of its bearing. When the handwheel is turned the nut travels on the screw, carrying the traversing bracket with it angular motion of the screw with reference to the axis of the carriage being permitted by the vertical pivots of the nut and the bearing. An azimuth pointer bolted to the left side of the elevating yoke indicates upon the azimuth scale the position of the gun in azimuth. The scale is carried by a bracket riveted to the left flask of the trail. It shows an allowable traversing movement of 140 millimetres, 70 on each side of the axis of the carriage, with graduations of a least reading of 5 millimetres.

ELEVATING MECHANISM.

The traversing bracket is extended to the rear by two side plates, the elevating yoke sides and a rear cross piece called the elevating yoke transom, of cast steel held solidly together by five bolts. The elevating yoke transom has a wide bearing surface resting upon the traversing transom liner, rear, and is provided with a clip finished on a radius from the pintle bearing center which embraces a mating part of the liner and prevents vertical motion of the elevating yoke. The elevating yoke sides are bored about a horizontal axis normal to the center line of the yoke and fitted with bronze bushings to receive the elevating gear bracket.

The elevating gear (Pl. XVI) is of the double screw type and consists of an inner and an outer elevating screw, an elevating gear bracket, a bevel gear, two bevel pinions, and two shafts with handwheels. The inner elevating screw is a steel screw, threaded with a right-hand thread. It is attached at its upper end by the elevating pin to the cradle band rear. The outer elevating screw is of bronze and is threaded on the exterior with a left-hand thread, while the bore is threaded with a right-hand thread to take the inner elevating screw. On the exterior are also cut two longitudinal keyways in which the keys of the bevel gear work.

The elevating gear bracket is bored out and threaded to take the outer elevating screw, and is provided with two trunnions, which rest in bearings in the elevating yoke sides. These trunnions are bored and bushed to form bearings for the elevating pinion shafts, of which there are two, one on each side, projecting through slots in

the flasks of the trail. A steel elevating bevel pinion is pinned and keyed on the inner end of each pinion shaft and meshes with a bronze elevating bevel gear mounted on the outer elevating screw in a seat slotted through the gear bracket. The bore of the bevel gear is fitted with two steel keys, which fit into the keyways in the outer screw. This arrangement constrains the outer screw to rotate with the bevel gear while permitting it a relative longitudinal motion. The revolution of the elevating handwheel rotates the pinions and through them the bevel gear. The outer screw turns with the latter and moves up or down in the elevating gear bracket according to the direction of its rotation. The inner screw is prevented from rotating by its attachment to the cradle and on account of the direction of its threads moves into or out of the outer screw as the latter is screwed into or out of the gear bracket.

For carriages with serial numbers 1 to 40, inclusive, an elevating screw cover of bronze is attached by three springs to the lower end of the bracket to exclude dust from below, while for carriages with serial numbers above 40, an elevating screw cover is attached to the bracket threads and is secured by a split pin. In traveling, the elevating gear should be run to the position of maximum elevation to house the screws in the elevating gear bracket. In this position, for carriages with serial numbers 1 to 40, inclusive, the face of the lug on the elevating bevel gear strikes against the elevating bevel gear stop on the rear cradle band, and for carriages with serial numbers above 40, the face of the lug strikes against a lug integral with the rear cradle band. The mechanism is designed to give a maximum elevation of 15° and a maximum depression of 5° .

ELEVATING AND TRAVERSING LOCK.

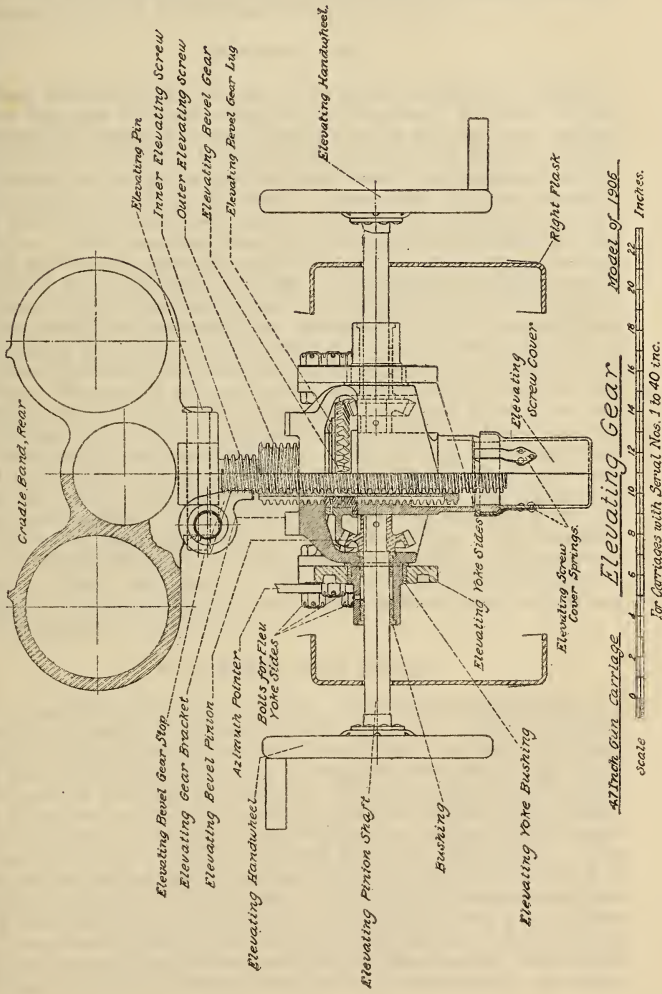
To relieve the pointing mechanism from all strains in traveling, an elevating and traversing lock is provided by which the cradle may be securely locked to the trail.

For carriages with serial numbers 1 to 40, inclusive, this arrangement is as follows:

A lock bolt is mounted in the lock bolt casing which is a bracket bolted to the traversing transom rear and tool box front transom. On the end of the lock bolt is riveted and pinned the lock bolt end on which is pinned the link. The lock bolt spring is located around the bolt in the casing and tends to keep the bolt toward the front. The lever fulcrum is threaded and pinned to the casing and acts as a fulcrum for the lever, one end of which is formed into a handle and the other is pinned to the link. On the tool box top plate is riveted the lever guide to which the lever is attached when the lock bolt is not secured in its seat on the bottom of the rear cradle band. The bolt is arranged to enter its seat when the gun is at 15° elevation and 0° azimuth.

Carriages with serial numbers above 40 have the following arrangement:

A lock bar is seated in bearings riveted to each flask. To the left end of the bar is pinned the lock bar lever on the end of which is



threaded the handle and in the handle is located a spring and plunger. When the gun is at 15° elevation and 0° azimuth the lock bar may be rotated until the lock bar fully engages the lug of the rear cradle band. In that position the plunger in the handle engages the lever fastening riveted to the left flask and locks the bar.

TRAVELING LOCK.

These elevating and traversing locks are sufficiently strong to secure the gun when traveling short distances. For use on long marches it is desirable to equalize the load on the wheels of carriage and limber. The gun is disconnected from the spring columns and piston rod and retracted until the breech lug engages the traveling lock provided in the trail. A cast-steel bracket—traveling lock frame—is riveted between the flasks some distance below the tool box. Two cast-steel traveling lock legs are pivoted in this frame, one on each side, the right leg having a folding prop for supporting it in an inclined position. The shifting of weights must be done with the elevating and traversing lock bolt or lock bar engaged with the cradle and the carriage limbered to avoid lifting the weights of the gun in limbering and to avoid the tendency of the piece to slide off the inclined cradle ways when not held by the springs. The spring rod and piston rod nuts being removed, the spring yoke and piston rod nut should be placed in the tool box and the spring rod nuts reassembled on the spring rods and secured by their split pins to prevent loss. The right leg of the traveling lock being raised and supported by its prop, the gun is slipped back until the breech lug stops against the leg. The left leg is now raised into position in front of the breech lug and the lock bolt and sleeve inserted and secured by the lock bolt nut. The traveling lock cover should be fixed in the fasteners provided for either the open or closed positions. No special tools should ordinarily be required for this operation, the standard pole or other improvised rod being used to start the gun.

ROAD BRAKE (TIRE BRAKE).

The road brake is of the lever type. Two brake shaft brackets are keyed to the axle, one on each side of the trail. Each is split and clamped to the axle with two bolts which lie in notches in the axle key and prevent displacement of the brackets and longitudinal movement of the trail on the axle. These brackets have bearing lugs with bronze bushings forward of the axle for the brake cranks, arms extending to the rear upon which are suspended the apron latches, and lugs to which is bolted the main shield plate. The brake shaft bracket, right, has also a fan-shaped flange to which is bolted a forged-steel brake segment. Two brake beams of cast steel are pivoted in lugs on the front of the pintle bearing and at their outer ends carry brake shoes of cast iron hinged on vertical pivots so as to bear against the rubber tires of the wheels. Brake rods in tension connect the forward ends of the brake beams to the brake

cranks upon the brake shaft. These rods are in several pieces; the brake rod passes through a stiff helical brake rod spring and the end of a bronze brake spring cover and is screwed into the brake rod end which is joined to the brake beam by the brake rod pin. The brake spring cover end is screwed into the brake spring cover, the spring being compressed between the forward end of the cover and a flange on the brake rod, which is arranged to have a small longitudinal movement against the pressure of the spring. Adjustment to compensate for wear of the brake shoes is secured by varying the distance the brake rod end is screwed upon the brake rod. The brake rod springs insure the desired pressure of the brake shoes on tires of wheels having variable radii. The hubs of the brake cranks form sleeves, assembled from the outside in the bearings of the brake shaft brackets. The brake shaft is squared at the ends to enter the brake cranks and is pinned to them to prevent longitudinal displacement. The squared right end of the shaft also carries a sleeve to which is hinged the brake lever. When the brakes are set, the lever is held by the teeth of the brake segment rack engaging the brake lever catch, a small steel piece riveted to the brake lever, and which may be replaced when broken or worn. A spring holds the lever and catch in contact with the segment. The brake is to be used as a firing as well as a road brake. *The brake should be used only when necessary, as the brake shoes bear directly on the rubber tires.*

ROAD BRAKE (BAND BRAKE).

The band brake equipment consists of a contracting band brake with lever located on the right side of the gun. Two brake shaft brackets are keyed and clamped by bolts to the axle, the right-hand one designed to support a rack segment for holding the brake lever in the required position. This lever through linkage tightens the brake bands on the flange steel drums that are bolted to the wheels. The linings of the brake bands are renewable. Band guides riveted to the bands and fitting in the band clips retain the bands in position.

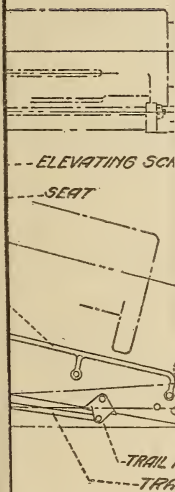
This brake is used both as a road and firing brake. The lugs on the pintle for holding the brake beams of the tire brake are omitted on band brake carriages. Also changes in the shape of the shields and the position of the sight cases have been necessitated on band brake carriages.

THE SHIELD.

The shield for the protection of the crew is hardened steel plate 0.15 inch thick, made in three parts—the apron, the main shield, and the top shield. The main shield is divided by the opening for the gun and cradle, the two sides being joined at the top by a flange steel hood, riveted on. It is rigidly attached by bolts to the brake shaft brackets and is braced by two main shield braces reaching from its upper corners to the trail flasks. The port in the left plate for the peep sight, when the sight is not being used, is covered by the peep sight port shutter. A catch on the rear of the shutter secures it in a

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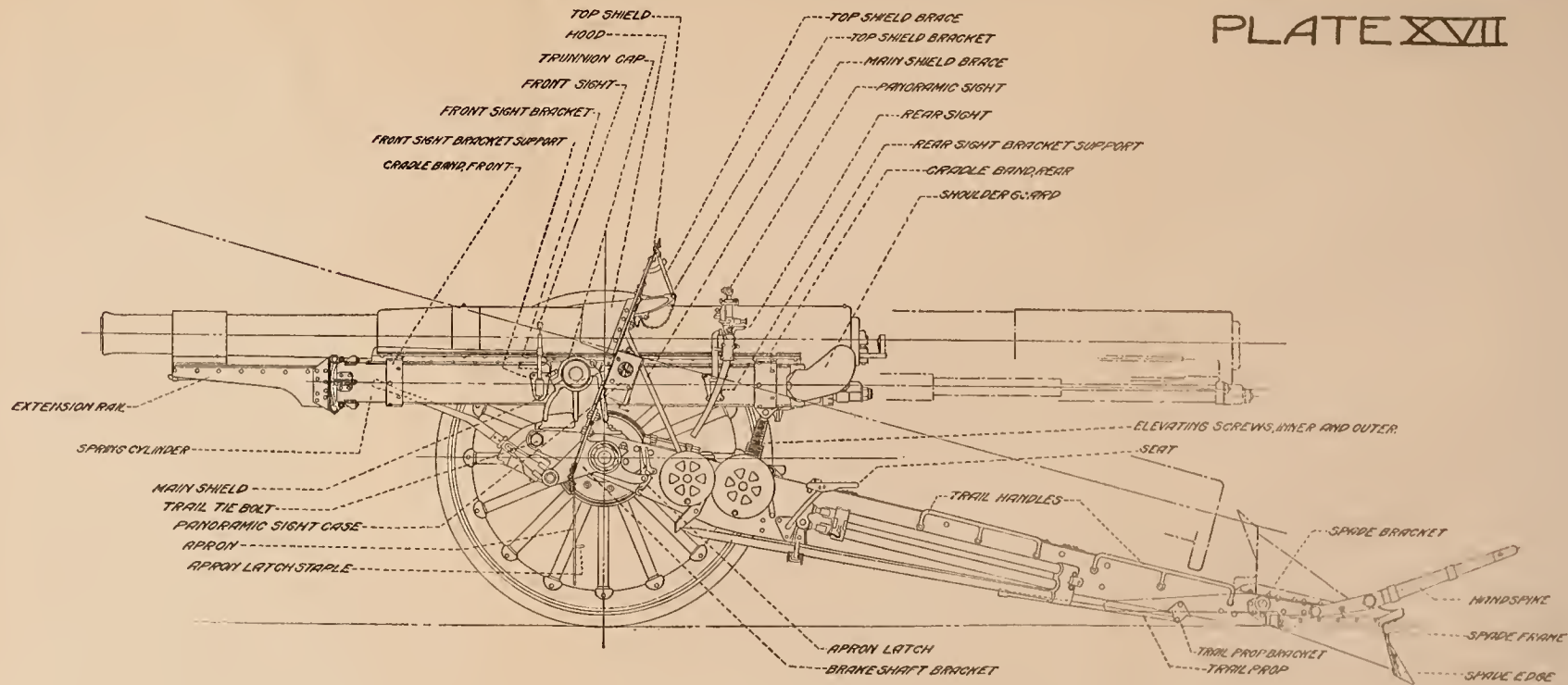


908

1/8 INCHES



PLATE XVII



4.7 INCH GUN CARRIAGE

SIDE ELEVATION

MODEL OF 1908



FOR CARRIAGE EQUIPPED WITH BAND BRAKE

closed position. To its lower edge, which is about 3 inches below the center line of the axle, is hinged the apron, 20 inches long. For traveling this is swung up to the rear and held by two apron latches attached to the arms of the brake shaft brackets.

The apron latch bodies are pivoted to the arms of the brake shaft brackets; the lower end of the latch body is formed into a hook which engages an apron latch staple riveted in the apron, and holds the latter in its traveling position. To prevent accidental disengagement of the hook from the staple, the opening of the hook is closed by the apron latch plunger seated in the body and pressed outward into action by a coiled spring. A grip lever, called the apron latch lever, is provided for withdrawing the plunger from the hook opening when it is desired to disengage the hook from the staple.

The top shield is hinged to the main shield and braced to two brackets on the main shield by the top shield braces, which serve to fasten the top shield in either the raised or folded positions. Raised, the upper edge of the top shield is about 69.25 inches above the ground, sufficient to afford protection from long range or high angle fire to cannoneers on the trail seats. Folded, the top is lowered to the rear to allow the panoramic sight line to sweep above it. The port in the top shield for the panoramic sight may also be closed, when the sight is not in use, by the panoramic sight port shutter, similar in design to the shutter used on the main shield.

SHOULDER GUARD.

For the protection of the cannoneer sighting the gun a shoulder guard is attached to the left spring cylinder at its rear end. The shoulder guard bracket is riveted to the cylinder, but the guard itself is detachable and is secured in place by a steel pin.

SIGHT AND RANGE QUADRANT TRAVELING CASES.

A leather-lined flange steel box, called the panoramic sight case, attached to the rear face (left side) of the main shield, provides a place for the panoramic sight in traveling. This box has a hinged lid, secured by a hasp and turnbuckle, and is provided with the usual padlock with chain for locking the box. The bronze supports for the sight case are fastened to the shield by four bolts. The sight case is supported between springs compressed in the supports and held in place by pins acting as spring rods. The mounting is such that the sight is well protected from injury due to shocks and jars. A similar case, called the range quadrant case, is mounted in essentially the same manner in supports bolted to the right flask of the trail, and is provided for the safe transport of the range quadrant. Packing blocks located in the tool box in the trail form a seat for the rear right shank. Canvas covers are provided for the front sight and rear sight brackets, the rear sight shank, and the sponge. They should be kept in place when these parts are not in use.

DESCRIPTION OF ONE OF THE ACCESSORIES.

Spring compressor No. 4 is now furnished for all carriages. It consists of a rope about 5 feet 7 inches long, having at one end a swivel and socket for attachment to the spring rod, and at the other end a socket for attachment to a plug on a 10-foot length of rope. This 10-foot rope is used only for passing the spring compressor through the spring columns. The spring compressor eye replaces it for attaching the compressor rope to the lifting hook of the duplex chain block. The operation is described on page 61.

This spring compressor is carried on the artillery supply truck, and two will be furnished per battery.

A list of the tools and accessories furnished with each carriage will be found on page 112.

DISMOUNTING AND ASSEMBLING GUN AND CARRIAGE.

To remove the recoil indicator throw: Withdraw the pins which attach the throw to the dust guard. The pins may be reassembled in the throw, with the split pins spread to prevent loss if the throw is to remain disengaged any length of time.

To dismantle the gun: Remove the recoil indicator throw, unscrew the piston rod and spring rod nuts, remove the spring rod yoke, and shove the gun to the rear until the clips are free from the cradle. The weight of the gun is carried by the duplex chain block and the chain sling provided for this purpose. If the gun is dismantled in the gun shed, the block may be attached to the roof; if in the field, it may be slung from the branches of a tree or some improvised tripod. In either case, the chain sling is looped around the gun, in front beyond the front clip, and in the rear between the clips and the gun lug. Burlap should be placed between to protect the various parts. It should be noted that the center of gravity is located about 51 inches from the rear face of the breech.

To mount the gun: Reverse the order of dismantling. The dust guard is to be assembled with the gun.

In moving the gun on or off the cradle, particular care must be taken to support the breech end, so that the gun clips are in prolongation of the cradle rails. The firing shaft is also quite liable to injury during this maneuver, and care should be taken to prevent its being struck by the muzzle of the gun or by implements in the hands of the cannoneers. The cradle should be placed at the desired elevation and azimuth before beginning either of these maneuvers and not changed during its progress, since the working of either the elevating or traversing mechanisms when the gun is only part way in battery brings an excessive and unnecessary strain and wear upon these parts.

To dismantle the extension rail on carriages with serial numbers 1 to 40, inclusive: The gun being ordinarily in retracted position, withdraw the extension rail pin, loosen the nuts of the extension rail bolts, and swing them free of the clips of the band, draw the rail forward and replace the extension rail pin in the extension rail. The extension rail is carried in the trail.

To assemble the extension rail in the trail for the same numbered carriages: Pull the pin in the forward fasteners of the extension rail carrier, shove the carrier to the rear and disengage the hook, slide the extension rail on the carrier, starting the front end of the rail on the forward end of the carrier until the catch of the carrier locks the two together; assemble the hook of the carrier in the trail first, and then engage the forward fasteners and pin.

To remove the extension rail of carriages with serial numbers above 40: The gun being ordinarily in the retracted position, disconnect the extension rail plungers and allow the extension rail to swing downward around the extension rail pin. Swing the extension rail rearward until the latch plunger on the extension rail engages the extension rail latch socket on the cradle. Assemble in the reverse order.

To dismount the recoil cylinder: Bring the cradle to approximately 0° elevation, remove the extension rail and piston rod nut. Release the recoil cylinder lock on the underside of the cradle band front by pulling the split pin and allowing the lock to drop out of the slot in the cylinder (for carriages 1 to 40, inclusive, it will be necessary to mark the slot with chalk or pencil for identification in assembling), unscrew the cylinder from its seat in the trunnion band, moving the end of the spanner wrench from the right side of the carriage toward the left, and withdraw the cylinder forward from the cradle.

Do not allow the threads on the cylinder or piston rod to strike the front band or become damaged in any way. Should the piston rod stick in the gun lug, it may be started by light blows from a block of wood after the cylinder is partially withdrawn from the cradle. The front end of the piston rod is close to the front head of the cylinder when both are in firing position. Hence battering the rear end of the piston rod will result in driving the piston against the front cylinder head to the probable damage of both.

To assemble the recoil cylinder: Reverse the operation of dismounting, screwing the cylinder into the trunnion band and assembling the cylinder lock in the notch. For carriages with serial numbers 1 to 40, inclusive, this notch should be that one which brings the threaded part of the cylinder nearest flush with the front of the trunnion band and the filling plug in the stuffing box on top.

To drain the recoil cylinder: For carriages with serial numbers 1 to 40, inclusive, bring the cradle to 0° elevation or slight depression, remove the drain plug in the front cylinder head and loosen the one in the stuffing box. Should the front plug not be in the lowest possible position, the cylinder may be rotated by loosening the recoil cylinder lock, or the cylinder may be entirely dismounted. As soon as thoroughly drained, replace the drain plug and tighten securely.

For carriages with serial numbers above 40, elevate the cradle to nearly maximum elevation and remove the drain plug near the lowest element of the stuffing box, and loosen the filling plug near the top element of the box. After the cylinder is thoroughly drained, replace the lower drain plug and tighten securely.

To fill the recoil cylinder: If the cylinder is not completely filled, loss of stability will occur and higher stresses than normal will be developed in the carriage; for this reason the cylinder should be filled with the greatest care; a commissioned officer should himself verify that the cylinder is full and that no air is left in it, with the exception of the void noted below.

The easiest way to fill the cylinder is to fill it when disassembled from the carriage. If this is impracticable, fill as follows: Depress the gun to maximum depression and remove the top filling plug in the stuffing box. Fill slowly through this hole, using the filling funnel furnished with the artillery supply truck. When apparently full, allow a few minutes for the oil to settle and pocketed air to escape and then refill. When satisfied that the cylinder is entirely full, remove the funnel and elevate the gun enough to allow about 10 cubic inches (about one-third pint) of oil to escape, thus providing a void for the expansion of the oil. Then screw the filling plug in tightly.

It may happen that after firing a few rounds the gun will not return to battery. This may be due to, first, weakness of springs; second, stuffing-box gland being screwed up too tightly; or, third, the oil having expanded, due to heat.

In either case the cause must be ascertained and remedied; if due to expansion of oil, it is proven by the fact that the gun can not be pushed into battery by force exerted on the breech. In that case depress to maximum depression and remove the filling plug. The oil will now escape, permitting the gun to return to battery.

Approximately 32 pints of oil are required for filling the cylinder. Hydroline oil of a specific gravity of 0.85 is furnished by the Ordnance Department for use in these cylinders; it is characterized by its low freezing point and by its noncorrosive action on metals. The oil used in the cylinder is to be clean and free from grit and dirt; to insure this it is to be strained through a clean piece of linen or muslin before using.

In emergencies water may be used in the cylinder. *This should be done only when absolutely necessary and never in freezing weather, and as soon as practicable the cylinder is to be emptied, cleaned, and thoroughly dried, and filled with hydroline oil.*

To remove the piston and piston rod: With the cylinder in the cradle, bring the cradle to 0° elevation and drain out the oil. Unscrew the front cylinder head and remove it with the counterrecoil buffer. Take off the piston rod nut, slacken the gland to release the pressure on the rod, and pull the piston and rod out to the front. In replacing the rod it will probably not be found necessary to remove the gland and packing. In dismantling or assembling the front cylinder head, the cylinder should never be clamped in a vise, as its walls are thin and not intended to withstand such usage. The rear cylinder head—stuffing box—should never be unscrewed.

To pack the stuffing box: The stuffing box is packed with five rings of Garlock's hydraulic waterproof packing, 0.375 square. The packing is issued cut into rings of such size that the ends meet around the piston rod. The latter being assembled, each ring, placed so as to break joints with the preceding one, is forced in succession to its seat

by a packing tool of copper or hard wood, one end of which is shaped like a carpenter's gouge and the other end forms a handle strong enough to stand light taps from a hammer. Such a tool may be readily improvised by the battery artificer. After the five rings are firmly seated in the box, screw the gland down on the packing.

In assembling the gland be sure that *at least six* of its threads are engaged with the threads of the stuffing box; otherwise the threads of the gland may be stripped in firing. With new packing it may be found difficult to insert more than four rings and secure sufficient engagement of the gland. In such a case the box should be packed with four rings and the piece fired a few rounds, after which the fifth ring should be inserted.

Adjustment of the gland: The adjustment of the gland will require the exercise of some judgment. If screwed up too tight, the frictional resistance of the packing on the piston rod will be so much increased that the countercoil springs may fail to return the gun to battery, especially at high angles of elevation. It should be screwed up just tight enough to prevent the leakage of oil through the stuffing box.

The necessity for dismounting parts of the recoil cylinder will seldom arise. It should be done only in the presence of a commissioned officer, who should see that the parts are handled with the greatest care. In assembling, the parts should be thoroughly cleaned, as the clearances in the cylinder are very small and the presence of small foreign particles may interfere with the proper working of the assembled parts.

To assemble the spring system: With the cradle at maximum elevation and the trail horizontal shove the first section of the outer springs into its spring cylinder until its front end is about 2 inches in, set up a separator against the forward end of this section and enter the second section, keeping the separator upheld between the sections; similarly when the outer end of the second section is 2 inches inside the spring cylinder enter the second separator and third section of spring. Shove the column in against the rear end of the spring cylinder (the front end of the last section will project about 30 inches), enter the outer stirrup and shove it in the outer springs until its forward flange rests against the end of the spring; it will then hold the last section in line. Proceed in like manner to assemble the intermediate spring sections and separators; the forward end of the last section will project about 20 inches from the outer stirrup. Place one section of the inner spring column in the inner stirrup and the two others, with the separators, on the spring rod. Pass the spring-rod connection end of the spring compressor rope through the stirrup and one section of spring from the rear and screw it on the rear end of the rod; the rope, stirrup, springs, and spring rod are now entered as one piece in the intermediate springs, the rope passing out the rear end of the spring cylinder. After the springs are located at their assembled free height as above, the spring compressor extension is disconnected and in its place is screwed the spring compressor eye. The lifting hook of the chain of the duplex block, secured to the rear end of the trail by passing the hook on the block under a crowbar placed

across and in rear of the handspikes or held by means of a picket rope, is brought forward and attached to the eye. The carriage should now be slightly traversed so that the taut rope will lie in the center line of the spring cylinder.

In compressing the springs it will be found that the flange of the outer stirrup tends to sag and catch on the front end of the spring cylinder, and at the same time the rear end of the stirrup must be carefully guided through the rear spring cylinder head; similarly the inner stirrup must be watched and guided as its flanges enter the outer stirrup. When the springs are sufficiently compressed the spring cylinder cover is to be assembled, care being taken to insure the exact adjustment of hinge pins and split pins or swing bolts. The compressor rope may now be slackened and disengaged from the spring rod and the other side of the system proceeded with. In assembling the other side of the system for carriages with serial numbers 1 to 40, inclusive, the same method is used and the spring rod yoke is attached when the two spring cylinder covers are in place.

In assembling the other side of the system for carriages with serial numbers above 40, it is necessary to secure the spring compressor block to the assembled spring rod and then remove the spring cylinder cover. When the two columns are assembled the cover is again attached, the block removed, and the spring rod yoke assembled in place.

As the spring columns are assembled under a load of 1,000 pounds, serious results may attend a sudden release by breakage of the rope or other part while under tension. The ropes should be carefully inspected before using, and all persons be required to keep arms and bodies away from the front of the spring column during these operations. Due to the inequalities of the spring pressure of the inner intermediate and outer springs, the outer or inner stirrup may project more to the rear on one side than on the other.

To dismount the spring system: With the cradle at maximum elevation and the trail limbered, remove the spring rod plug nuts and the spring rod yoke. For carriages with serial numbers above 40, the spring compressor block should be attached to that spring rod, not being dismounted.

Screw the spring compressor rope or body in its position on the rod to be dismounted and make the rope taut by means of the block located as above. Traverse the cradle slightly so that the taut rope lies in the center line of the spring cylinder. Remove the cylinder cover and slowly unwind the rope until the springs are free. If necessary to remove the other column for carriages with serial numbers above 40, it will be necessary to replace the spring cylinder cover before removing the spring compressor block.

To dismount the shield: Disconnect the apron by pulling the hinge pins, remove the bolts fastening the main shield to the trail, take off the main shield braces and main shield side plates, and lift the shield plate off to the rear.

To dismount the cradle: Remove the gun, shield and elevating pin, take off the trunnion caps, and lift the cradle from the pintle yoke.

To dismount the traversing gear: Remove the bolts securing the traversing screw bracket to the trail; the screw may then be disengaged from the nut and taken out with the bracket, bearing, and cap; the nut and traversing screw bearings are freed by removing their cap bolts. In assembling, the oil plugs in the bearing and the traversing nut are to be placed on top.

To dismount the elevating screws: Remove the elevating pin; unscrew the inner screw by hand; remove the elevating screw cover; remove the outer screw by screwing it down through the elevating gear bracket.

To dismount the pinions and bevel gear: Remove the split pin in the pinion hub, after which the pinion shaft may be withdrawn and the pinion removed from its seat. The bevel gear may then be removed by dismounting the screws, as above.

To dismount the elevating gear bracket: Free the mechanism from the cradle by removing the elevating pin; dismount the pinions and pinion shafts as above; remove the five bolts attaching either elevating yoke side to the traversing bracket and elevating transom; the bracket may now be slipped free from the other side of the yoke.

To assemble the elevating mechanism: The operations just described are reversed. The following should be noted: The pinions are a close fit on their shafts, and especial care should be taken not to burr the parts in assembling. As the outer screw is being assembled in the gear bracket from below, the bevel gear should be put in place with its keys engaging the keyways of the screw. Before attaching the inner screw to the cradle both screws should be run down to be sure that the upper end of the outer screw is flush with the face of the gear bracket when the inner screw is clear in and its head in position to engage the cradle and that the lug on the elevating bevel gear functions properly against the elevating bevel gear stop on the rear cradle band or the lug integral with the band. If this condition is not fulfilled, the mechanism may not give the maximum elevation for which it is designated and will not house properly in traveling nor will the elevating and traversing lock function correctly.

To dismount the tire brake: Disconnect the brake rods by pulling the pins in the beams and taking the nuts from the cranks; in reassembling, the rods will be first assembled to the cranks and then in the beams. To remove the beams from the pintle bearings it is necessary to dismount the recoil cylinder to get out the hinge pins; the brake shoe is freed from the beam by withdrawing the brake shoe pin. The brake beams with shoes attached are rights and lefts and are properly assembled when the shoe has a full bearing upon the tire. To take out the brake shaft, remove the left wheel and the pin of the right crank; the shaft and left crank may be pulled out to the left. In assembling the shaft, note that the cranks are to be in line, with the brake lever and hinge *opposite* them on the shaft. The tension of the brake rod spring is regulated by removing the split pin which passes through the brake spring cover and screwing the brake spring cover end in or out of the cover. The tension of the spring is increased by screwing the end into the cover. The

length of the brake rod should be adjusted by screwing the front end of the rod into or out of the brake rod end.

To adjust the brakes: The brake rods are disconnected from the brake beams. The brake shoes are placed with the clearance from the tire desired and the brake lever with the brake lever catch engaging the forward notch (extreme released position). The length of the brake rods should then be adjusted to correspond. Should test show that one shoe bears harder on the wheel than the other, the rod of the latter should be shortened.

To dismount the band brake: First jack up carriage and remove the left wheel. Then draw the split pin, located at middle of brake shaft, which holds the brake lever sleeve on the brake shaft, draw the split pins on the ends of the brake shaft, unscrew the crown nuts, slide off the brake band ends lower, which will draw with them the adjusting bolt eyes with their bushings and the four brake cranks. The brake shaft may then be drawn through the brake shaft bracket and the band guides removed from the band clips.

To adjust the band brakes: Remove the pin holding the adjusting bolt sleeve in the brake band end (upper); then free the adjusting bolt sleeve and screw it up or down on the adjusting bolt eye till, with the brake lever in the extreme released position, there is no friction between the brake drums and brake linings. On applying the brakes there should be the same amount of friction on each drum; if such is not the case the adjusting bolt sleeve of the one having the least friction should be tightened till the friction on both is equal.

To remove a wheel: Support the axle in order to bring the wheel clear of the ground. Lift up the flap of the hub latch, thus disengaging its bolt, and unscrew the hub cap; the wheel fastening which is now exposed is secured to the axle by a spring pin in one side; when this is pressed back the wheel fastening may be lifted free of the axle and the wheel slipped off.

To remove a hub liner: Take the wheel from the axle and drive the liner out by striking with a heavy hammer or sledge upon a suitable wooden or metal block placed against the small end of the liner. A hub liner driving tool is carried on the artillery supply truck for this purpose. In assembling a new liner be sure the surfaces are perfectly clean and that no dirt gets under the flange of the liner to prevent its being driven solidly against the face of the hub. Unless the liner is forced completely into the hub the distance from the face of liner to the small end of the hub may be too great to allow the assemblage of the wheel fastening. Should the outer end of the liner project beyond the small end of the hub it may be filed flush.

To dismount the traversing bracket and pintle yoke: The gun, cradle, and main shield being off, dismount the traversing screw and elevating pinion shafts, withdraw the bolts connecting the traversing bracket and pintle shape; the bracket may be withdrawn forward, the pintle yoke given one-sixth of a turn and lifted from the pintle bearing.

To dismount the trail and axle: The wheels, shield, cradle, brake, etc., having been removed as described above, remove the clamping

bolts from the brake shaft brackets, slip the brackets off the axle, and loosen the clamping bolts in the axle bearings; the axle may then be withdrawn from the trail.

The parts of this carriage in general are made with sufficient clearance to permit of the assemblage of any part without the use of force. In assembling them no part should be directly struck with a hammer. If resort to force is necessary, a piece of wood or a copper drift should be interposed between the hammer and the part struck. Most of the nuts and pins are provided with split pins as keepers. The split pins must, of course, be removed to remove the nut, and when the nut or pin is assembled the split pin should be inserted and properly opened. When bolts are removed it is a good plan to screw the nuts back on the bolts to keep the threads of both clean and undamaged until they are restored to the carriage. A pair of wire-cutting pliers is provided for use in pulling split pins, cutting wire lashings, etc.

CARE AND CLEANING OF RECOIL CYLINDER AND OTHER PARTS OF THE CARRIAGE.

The carriage is a machine for controlling the recoil of the gun, and must be properly cleaned and cared for to insure its working correctly. The officers responsible for the efficiency of the battery should familiarize themselves with the carriage mechanism and with the foregoing instructions as to the methods of mounting and dismounting the various parts, and should see that the carriage is properly handled, cleaned, and cared for. The following general directions for its care and cleaning are given:

The recoil cylinder should be emptied and refilled once every three months, and thoroughly cleaned once every six months, or oftener if the conditions require it. The cylinder is most readily emptied and filled when removed from the carriage. For cleaning, it is dismounted and the cylinder head, counter recoil buffer, and piston rod removed, as heretofore described. The interior of the cylinder, the piston, the counter recoil buffer, and the stuffing box should then be thoroughly cleaned by the use of cotton waste and kerosene oil and wiped dry with cotton waste. The removal of the packing is not necessary in cleaning the stuffing box. The cylinder bore should be carefully inspected, and if any rust has formed it should be removed with kerosene oil, using, if necessary, *fine* emery cloth. The latter must be used with great care to prevent any increase in the clearance between the cylinder and piston. If rubbing, burring, or scoring of the parts is noted, the rough spots should be carefully smoothed down by a skilled workman with a dead-smooth file or with emery cloth, and the cause of the roughness ascertained and removed. Where unusual rubbing or scoring has occurred, the facts will be reported to the officer of the Ordnance Department charged with the duty of keeping the battery in repair, for his information and action.

The parts should be reassembled immediately after cleaning and inspection and the cylinder filled with the hydroline oil issued for

that purpose. The piston should be moved back and forth in the cylinder by hand to make sure that all parts are correctly assembled and are without interference. The cylinder should then be mounted in the carriage and the gun pulled from battery by hand, using the Duplex chain block and the retracting eye carried on the artillery supply truck and permitted to counter recoil rapidly to insure that all parts are in proper position for firing. *This should never be done, however, unless the cylinder is known to be filled with oil.* In reassembling the parts the condition of the fiber washer between cylinder head and recoil cylinder should be noted; it should be replaced whenever necessary to prevent leakage. In removing and inserting the piston rod care should be taken to keep it central in the cylinder, so as not to bind, burr, or spring any parts. The dismounting and reassembling of the parts of the cylinder should in every case be supervised by a commissioned officer. Before firing, an inspection should be made to ascertain that the different parts, especially the piston rod and spring rod plug nuts, are correctly assembled.

The recoil cylinder oil should be stored in the closed cans provided for the purpose, and be carefully protected from dirt, sand, or water. Oil withdrawn from cylinders and containing any sediment must not be used again for any purpose until it has been allowed to settle for not less than 24 hours. When sediment has thus been permitted to settle, great care must be taken not to disturb it in removing the oil. To insure the cleanliness of all cylinder oil it should be strained through a clean piece of linen or muslin before using.

The counter recoil springs should be dismantled at least once every six months and be thoroughly cleaned. All rust should be removed and the springs well oiled before assemblage. When the springs are dismantled the interiors of the cradle should be cleaned and examined for defective riveting, missing rivet heads, and scoring. The stirrups should be carefully examined for bulged or cracked ends and loose rivets, and all burrs or scores on the bronze heads carefully smoothed off.

The recoil guide rails of the cradle should be kept well lubricated. Immediately before beginning to fire, they should be oiled through all the oil holes of the gun. Lack of proper lubrication of these guide rails is the most frequent cause of failure of gun to return fully into battery.

The elevating and traversing mechanisms should be dismantled at least once every six months for thorough cleaning and overhauling. They should be kept well oiled and should work easily. If at any time either mechanism works harder than usual it should be immediately overhauled and the cause discovered and removed.

In traveling the cradle should be locked to the trail by means of the elevating and traversing lock, so as to relieve the pointing mechanisms of all travel stresses.

The wheels and wheel fastenings should be dismantled periodically and the fastenings, hub boxes, axle arms, and axle bore cleaned and examined. All roughness due to scoring or cutting should be

smoothed off. In oiling the wheels in service a small quantity (about 1 gill) of lubricating oil should be placed in the axle bore through the oil valve in the hub cap. A short experience will enable the battery commander to determine how often the wheels should be oiled.

The nuts on the hub bolts should be tightened monthly the first year of service and twice a year thereafter. The ends of the bolts should be lightly riveted over to prevent the nut from unscrewing. When the hub bolts are tightened, the hub band should be screwed up as tightly as possible against the lock washer at the outer end of the wheel hook bushing.

The wooden parts of the wheels are made of thoroughly seasoned materials, and the hub bolts and bands, when the wheels are issued, are properly tightened; but all wood is susceptible to change with atmospheric conditions, so that the spokes speedily become loose, and if the wheel is used in this condition it will rapidly be made unserviceable and may be damaged beyond repair.

The importance of strict compliance with these instructions can not be overestimated.

All working and bearing surfaces of the carriage require oiling; those not directly accessible for this purpose are provided with oil holes closed by spring covers or bronze plugs. Each component part of a carriage is made interchangeable with the similar parts of other carriages of the same model, except that certain parts are not interchangeable between carriages with serial numbers from 1 to 40, inclusive, and those with numbers above 40, as noted in the table of nomenclature of parts, page —, and is, except in the case of certain springs and very small parts, stamped with an individual symbol number and letter; this symbol may be followed by an additional number which indicates a slight change in design from the original. When requisitions for replacements are to be made *the symbol should be copied thereon exactly as stamped upon the unserviceable piece.*

THE 4.7-INCH GUN AND 6-INCH HOWITZER LIMBER, MODEL OF 1905.

(This limber is common to the 4.7-inch gun and 6-inch howitzer batteries.)

WEIGHTS, DIMENSIONS, ETC.

Weight, complete, including spare connecting pole..	pounds..	1,750
Weight, with 4.7-inch gun and carriage, model of 1906. do. . .		9,818
Diameter of wheels (rubber tired).....	inches..	51
Width of track.	do....	60
Free height under limber and carriage.	do....	16.8

NOMENCLATURE OF PARTS.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Axle.....			
2	Bucket holders.....	Riveted to side braces.....		
4	Bucket straps.....	In strap fasteners.....		
8	Bucket strap fasteners, Style No. 1.	Rivited to bucket holders.....		
1	Center angle, left.....	Under axle.....		
1	Center angle, right.....	do.....		
1	Center angle plate.....	Over axle.....		
1	Clip.....	Braces top carriage rail at center.		
1	Doubletree pivot strap.....	Bearing for doubletree.....		
1	Eye rivet.....	On underside of pintle bearing.....		
1	Name plate.....	On right side of pole housing.....		
1	Pintle, complete, consisting of—			
1	Pintle.....	Through pintle bearing.....		
1	Lower bushing.....	In lower end of pintle.....		
1	Key.....	In side of pintle.....		
1	Pintle nut.....	On lower end of pintle.....		
1	Upper bushing.....	In upper end of pintle.....		
1	Pintle bearing.....	Rivited to rear ends of center angles and center angle plate.		
1	Pintle bolt, complete, consisting of—			
1	Pintle bolt.....	Through pintle.....		
1	Pintle-bolt lever.....	On lower end of pintle bolt.....		
1	Bolt snap.....	Snaps into eye rivet.....		
1	Chain.....	Holds pintle bolt in locked position.		
1	Ring.....	Through hole in end of pintle-bolt lever.	IV	3
1	Pole bracket, left.....	} Support pole socket.....		
1	Pole bracket, right.....			
1	Pole bracket reinforce, left.....	Rivited to pole bracket, left.....		
1	Pole bracket reinforce, right.....	Rivited to pole bracket, right.....		
1	Pole housing.....	Over rear of pole socket.....		
1	Pole pin.....	Secures pole in socket.....		
1	Pole prop pocket.....	} Rivited to side brace, left.....		
1	Pole prop support.....			
1	Pole prop strap.....	In strap fasteners.....		
2	Pole prop strap fasteners, style No. 2.	Rivited to side brace, left.....		
1	Pole socket, complete, consisting of—	Hinges in pole brackets.....		
1	Pole socket body.....			
1	Pole socket clamp.....	Rivited to pole socket body.....		
1	Pole socket end.....	Over end of pole socket body.....		
1	Pole socket reinforce.....	Rivited to top of pole socket body.		
1		Under rear of pole socket.....		
1	Pole stop.....			
1	Rail bracket, left.....	} Brace top carriage rail at sides.....		
1	Rail bracket, right.....			
1	Side brace, left.....			
1	Side brace, right.....			
1	Spare connecting pole bracket (front).	Rivited to center angles.....		
1	Spare connecting pole bracket (front) upper strap.	Rivited to spare connecting pole bracket (front).		

Nomenclature of parts—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Spare connecting pole support complete, consisting of—			
1	Spare connecting pole support (lower).	Hinged to spare connecting pole support (upper).		
1	Spare connecting pole support (upper).	Bolted to frame in front of pintle.		
1	Spare connecting pole support pin.	Locks pole support (lower) in position.		
1	Chain, with bolt snap and two rings.	In end of connecting pole support pin.		
1	Chain rivet	In pole support (lower)		
1	Top carriage, complete, consisting of—			
1	Top carriage	Turns in pintle bearing		
2	Top carriage clips	Bolted to top carriage		
3	Rollers	On roller pins		
3	Roller pins	Flinned in top carriage		
1	Top carriage rail	Bearing for top carriage rollers		
2	Wheels, 51-inch rubber tired complete, including—			
2	Hub boxes			
2	Hub rings	Outer flanges of hubs		
2	Hub liners	Forced into hub boxes		
2	Hub bands	Screwed on hub boxes between wheel hook bushing and hub caps.		
2	Lock washers	On end of axle		
2	Wheel hooks—			
	1 right	On outside of hubs	IV	3
	1 left			
2	Wheel hook bushings	Under wheel hooks		
2	Hub caps	On end of hubs		
2	Hub latches complete	Actuate hub latch plungers		
2	Hub latch springs			
2	Hub latch plungers	Lock hub caps in place		
2	Wheel oil valves, complete	Slide in hub caps		
2	Oil valve springs			
2	Oil valve rivets			
2	Oil valve washers			
32	Spokes, 16 right, 16 left			
8	Felloe segment, bent, with 16 bolts and washers.	Bolted to felloe bands		
2	Felloe bands	Bolted to felloe segments		
2	Base bands	Shrunk over felloe bands		
2	Tires, rubber	On base bands		
32	Spoke shoes and rivets	Hold spokes to felloes		
32	Spoke shoe plates	Between spokes and felloes		
16	Carriage bolts and nuts	Clamp spokes between hub boxes and rings.		
2	Wheel fastenings, complete, including—			
2	Wheel fastenings	At ends of axles		
2	Wheel fastening plungers			
2	Wheel fastening springs			
2	Wheel fastening plugs			

DESCRIPTION.

(Plate XVIII.)

The carriage limber is designed to be used with the connecting pole for attachment to a tractor and to support the trail in traveling. The principal parts are the wheels, axle, frame, top carriage, pole socket, and connecting pole. The limber is made of metal throughout, wood being used only in the spokes and felloes of the wheels.

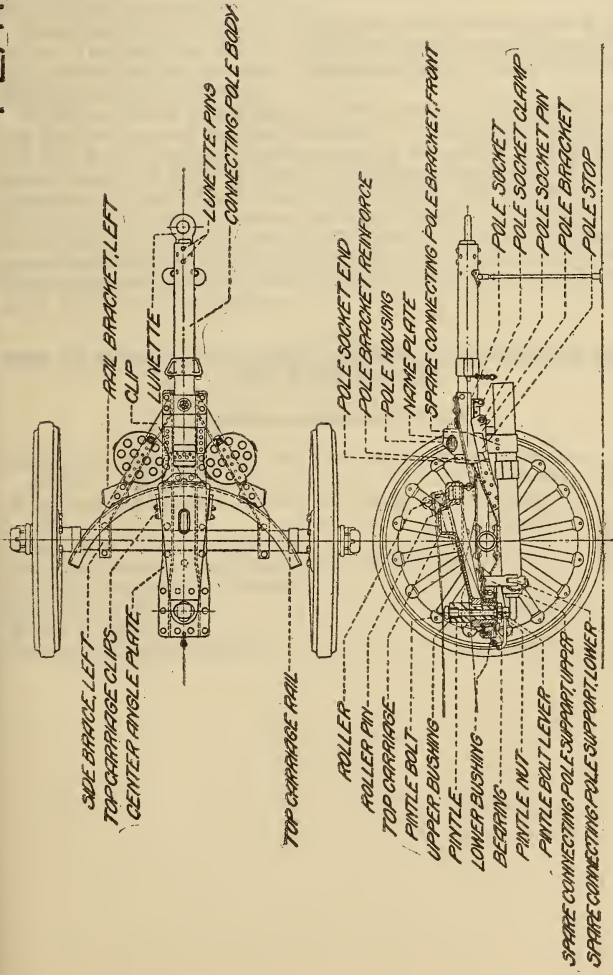
The top carriage is formed for use with the trails of either the 4.7-inch gun carriage, model of 1906, or the 6-inch howitzer carriage. The trail of the carriage rests on the top carriage of the limber. When the limber is turning a corner the top carriage revolves about the pintle center, rolling on the top carriage rail of the limber frame.

A wide flange steel center angle plate is riveted to the axle as a middle rail, and with the braces of heavy steel angles underneath and at the sides forms a trussed frame for the vehicle. Sixteen inches to the rear of the axle a bronze bearing for the pintle is solidly riveted between the rear ends of the center angle plate and center angles. Forward, these converge with the side braces and form a yoke in which the pole socket may oscillate in a vertical plane. The front ends of this yoke are connected by the riveted doubletree pivot strap. A seat for the doubletree is formed on the top of the doubletree pivot strap; the doubletree pivot is screwed into this seat and projects up through the doubletree; its upper end is threaded for a crown nut and is braced back to the pole housing, a flange steel part which constrains the pole socket in its vertical plane and limits the upward movement of its rear end. The pole socket is of flange steel with its forward end split and furnished with a clamp bolt for drawing firmly about the connecting pole. The doubletree, single-trees and pole complete are omitted for motorized batteries and a connecting pole is used in their place.

The pole pin passes through pole brackets and pole bracket reinforces, riveted on each side of the yoke, and the clamp forging of the socket, securing the socket to the frame. Between the pole housing and the pole stop the socket may swing through an angle of about 31° with the socket pin as an axis. This pivoting of the pole is necessary, as the entire limber body rotates about the axle in passing over uneven ground.

The top carriage rail is a steel angle bent to the arc of a circle and located on the frame with the center of the arc at the pintle center. It is riveted to the side braces by the rail brackets and to the center angle plate by a suitable clip.

The top carriage is a steel casting. Its rear end fits in the bearing of the frame and is bored to receive the steel pintle, a heavy pin with a long head of elliptical section, keyed in with the major axis of the ellipse on the center line of the top carriage. The pintle bolt in the center of the pintle has an elliptical head to match the pintle and at its lower end a lever with chain and snap fastening. When a carriage is to be limbered, the bolt is turned until its elliptical head coincides with the pintle so that both may enter the elliptical



4. INCH GUN AND 6. INCH HOWITZER LIMBER, MODEL OF 1905

lunette transom bushing of the carriage trail; once so entered the pintle bolt is turned 90° in the pintle and secured by its chain in that position, the head thus preventing the disengagement of pintle and lunette.

The front end of the top carriage is provided with three bronze conical rollers which rest and run on the top carriage rail; and with clips which embrace the edge of the rail to prevent accidental dismounting. There is also a spur located on the top of the top carriage which enters the trail end reinforce plate of the carriage and holds the trail and top carriage in line.

The wheels are 51 inches in diameter, with rubber tires 4 inches wide. The hubs are exactly similar and interchangeable with those in the wheels of the carriage. The axle is hollow and is made from a single piece of forged steel.

A bucket holder with straps is located on each side brace for carrying the four canvas watering buckets. A name plate is riveted to the left side of the pole housing, giving number, name of limber, model, name of manufacturer, year of completion, and initials of inspector. *In all reports and correspondence, the limber should be designated by the number, name, model, etc., as given on the name plate.* As repairs to the limber may from time to time be required, the parts needed should be referred to by the names given in the nomenclature of parts, and the symbols should be copied exactly as stamped upon the unserviceable pieces.

THE 4.7-INCH GUN CAISSON MODEL OF 1916 (BAND BRAKE AND TIRE BRAKE).

WEIGHTS, DIMENSIONS, ETC.

Weight of caisson, empty, without implements or ammunition.....	pounds..	2,565
Weight of implements carried, including spare connecting pole.....	pounds..	180
Weight of ammunition carried.....	do....	2,067
Weight of caisson, complete equiped and loaded.....	do....	4,812
Rounds of ammunition carried.....		28
Diameter of wheels.....	inches..	61
Width of track.....	do....	60
Free height under caisson.....	do....	20.8

NOMENCLATURE OF PARTS.

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Adjusting bolt ¹	Pinned to brake shaft lever....	IV	3
28	Ammunition chest connecting piece.	Connects front and middle diaphragms.		
1	Apron.....	Hinged to chest bottom.....		
3	Apron hinge, male.....	Riveted to apron.....		
3	Apron hinge, female.....	Riveted to chest bottom.....		
2	Apron latches, complete, including—			
2	Latch bodies.....	On latch bases riveted to chest sides.		
2	Plungers.....			
2	Latch handles with pins.....			
2	Latch springs.....			
2	Apron latch staple.....	Riveted to apron.....		
2	Apron latch washer.....			
1	Ax handle bracket.....	Riveted to top of chest.....		
1	Ax pocket.....	do.....		
1	Axle.....	In axle bearing.....		
2	Axle bearing.....	Riveted to sides of chest.....		
8	Axle bearing reinforce plate.....	Riveted on inside of chest.....		
2	Band bearing, inner ¹	On brake shaft and in brake band end, upper. do.....		
2	Band bearing, outer ¹	do.....		
2	Band clip ¹	Riveted to sides of chest.....		
2	Band guide ¹	Riveted to brake band.....		
2	Brake band ¹	Riveted to brake band ends.....		
2	Brake band lining ¹	Riveted to brake band.....		
2	Brake band end, lower, 1 right, 1 left. ¹	Screw into adjusting bolt.....		
2	Brake band end, upper, 1 right, 1 left. ¹	Fits bushings on brake shaft ends.		
2	Brake beams, complete, including— ²			
2	Bodies ²	Hinged to brackets on rear of chest.		
2	Brake beam clips ²			
2	Brake beam stiffeners ²			
2	Brake shoe bearings ²			
4	Brake beam hinges ²			
2	Brake beam bracket ²	Riveted to rear plate.....		
2	Brake beam pin ²	Hinges beams to brackets.....		
1	Brake crank with washer ²	On right end of brake shaft.....		
2	Brake drum ¹	Bolted to wheels.....		
1	Brake guard ²	Riveted to left side of chest.....		
1	Brake lever, with washer ²	On left end of brake shaft.....		
1	Brake lever ¹	do.....		
1	Brake lever catch ²	Riveted to brake lever.....		
1	do. ¹	Riveted to brake lever and brake lever hook.		
1	Brake lever hook ¹	Riveted to brake lever.....		
1	Brake lever rest ²	Riveted to left side of chest.....		
1	Brake lever rest spring ²	Riveted to brake lever rest.....		
1	Brake lever sleeve ¹	Pinned on brake shaft.....		
1	Brake lever stop rivet ¹	Riveted through segment rack and supports.		

¹ For band brake model only.² For tire brake model only.

Nomenclature of parts—Continued.

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Brake rod, complete, including— ¹			
2	Brake rod ¹	Attached to brake crank and brake lever and to the brake beams.		
2	Brake rod key ¹			
2	Brake rod end with pin ¹			
2	Brake rod bushing ¹			
2	Brake rod spring ¹			
2	Brake spring cover ¹			
2	Brake spring cover end ¹			
1	Brake shaft ²	In brake shaft bearings passing through chest.		
1	do. ¹	do		
2	Brake shaft bearing ¹	Riveted to sides of chest.		
1	Brake shaft bearing, bracket ²	Riveted to left side of bracket..		
1	Brake shaft bearing, left ² ...	Bolted to brake shaft bearing bracket		
1	Brake shaft bearing, right ² ..	Riveted to right side of chest..		
2	Brake shaft lever ²	Fits on brake shaft ends.....		
2	Brake shoe ¹	On brake beams.....		
1	Bushing ²	In brake shaft bearing, left..		
1	do ²	In brake shaft bearing, right..		
1	Bucket holder body.....	Riveted to rear plate.....		
2	Box slide, 1 right, 1 left.....	Riveted to lower intermediate plate, left side.		
1	Caisson prop, complete, including—			
2	Prop tubes.....	Under connecting pole.....	IV	3
1	Prop foot.....			
2	Prop eyes.....			
2	Prop chain clamp.....			
1	Prop hook.....			
2	Prop chain.....			
1	Cartridge hook bracket.....	On right side of chest.....		
1	Cartridge hook support.....	do		
1	Chest angle.....	Riveted around chest at rear..		
1	Chest body, upper and lower plates.			
1	Chest door, lower.....	Hinged to bottom front of chest.		
1	Chest door, upper.....	Hinged to top front of chest ...		
1	Connecting pole, complete, including—			
1	Body.....	Keyed to connecting pole socket.		
1	Key bearing.....			
1	Lunette.....			
1	Lunette bearing.....			
2	Lunette pins, 1 front, 1 rear.			
1	Prop saddle.....			
1	Connecting pole key.....	Connects connecting pole to socket.		
1	Connecting pole socket.....	Riveted to intermediate plates.		

¹ For tire brake model only.² For band brake model only.

Nomenclature of parts—Continued.

Number on caisson.	Name of part.	Location, etc.	Property classifica- tion.	
			Class.	Sec- tion.
1	Coupling sleeve ¹	On brake lever sleeve.....	IV	3
12	Diaphragm brace.....	Rivet to upper diaphragms.....		
1	Door angle (for upper chest).....	Stiffens edges of door.....		
1	Door angle (for lower chest).....	do.....		
2	Door end stiffener, 1 right, 1 left.....	Riveted to lower door.....		
2	Door handle, lower, 1 right, 1 left.....	do.....		
7	Door hinge, male.....	.....	
7	Door hinge, female.....	.....	
2	Door prop.....	Fastened to upper door and chest sides.		
1	Door handle bar (upper).....	On front of door.....		
2	Door handle base (upper).....	do.....		
2	Door prop bracket.....	Riveted to upper door.....		
2	Door prop guide, 1 right, 1 left.....	Riveted to chest sides.....		
2	Door prop pin.....	.....	
2	Door prop sliding rivet.....	.....	
2	Door stiffener, lower chest.....	Riveted to lower door.....		
4	Door stiffener, upper chest, 2 right, 2 left.....	Riveted to upper door.....		
1	Filler plate.....	Riveted to pintle bearing sup- port.		
1	Footrest.....	Riveted to foot rest supports.....		
2	Foot rest support, 1 right, 1 left.....	Riveted on rear plate.....		
1	Front diaphragm, lower.....	Riveted in front of chest.....		
1	Front diaphragm, upper.....	do.....		
1	Fuze box holder (front door).....	Riveted to fuze box support.....		
1	Fuze box support (front door).....	Riveted to upper door.....		
2	Fuze box strap (between chests).....	Riveted to lower intermediate plate.		
2	Handle, 1 right, 1 left.....	On lock bars.....		
2	Handle catch.....	In handle catch bearing.....		
2	Handle catch bearing, 1 right, 1 left.....	On sides of chest.....		
2	Handle catch rivet.....	In handle catch bearing.....		
4	Handrail shank.....	Riveted on chest sides.....		
2	Handrail.....	Forced and riveted on shanks.....		
1	Hatchet blade bracket, body.....	Riveted to left side of chest.....		
1	Hatchet blade bracket, han- dle rest.....	do.....		
1	Hatchet handle bracket.....	do.....		
1	Intermediate plate, lower.....	Riveted in chest parallel to bottom below axle.		
1	Intermediate plate, upper.....	Riveted in chest parallel to bottom above axle.		

¹ For band brake model only.

Nomenclature of parts—Continued.

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Lantern bracket, complete, including—	On rear of chest	IV	3
1	Lantern bracket body..			
1	Lantern bracket bottom.			
1	Lantern strap fastener.			
1	Lantern strap			
2	Latch base, 1 right, 1 left	Riveted on sides of chest		
2	Lock bar	On chest front		
2	Lock bar bracket, 1 right 1 left.	On sides of chest		
4	Lock bar pin	Forced in lock bar		
8	Lock bar washers .....	.....	
8	Locking lever	On front of chest		
4	Locking lever bearing .....	.....do	
1	Middle diaphragm, lower .....	.....	
1	Middle diaphragm, upper .....	.....	
1	Name plate	On rear of chest by lantern bracket.		
2	Nut strip	Secure pintle bearing bolts		
2	Oil can guide, 1 right, 1 left.	On intermediate plate, lower ..		
1	Oil can lock	Riveted to lower door handle, right.		
1	Oil can stop plate and 4 washers.	Riveted between intermediate plates.		
1	Padlock, bolt snap, clevis and chain rivet.	On left side of chest		
1	Pick handle rest .....	.....do	
1	Pick rest .....	.....do	
1	Pintle	In pintle bearings		
2	Pintle bearing	Bolted to pintle bearing supports.		
4	Pintle bearing bolt	Through pintle bearings and supports.		
1	Pintle bearing support, lower.	Riveted to lower intermediate plate.		
1	Pintle bearing support, upper.	Riveted to upper intermediate plate.		
1	Pintle latch	On pintle		
1	Pintle latch pin	Through pintle and latch		
1	Pintle latch spring	On pintle latch		
1	Pintle spring	Held by pintle spring guide and bolt.		
1	Pintle spring guide	Riveted to pintle support, lower.		
2	Plate, lock bar, 1 right, 1 left.	On sides of chest		
1	Pole socket key bracket	On right side of chest		
1	Poplar block	For oil can stop		
1	Rear diaphragm, lower	Inside chest parallel to rear plate.		
1	Rear diaphragm, upper .....	.....do	

Nomenclature of parts—Continued.

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Rear plate.....	Riveted to chest angle.....	IV	3
2	Reinforce plate, 1 lower, 1 upper.	Riveted with pintle bearing supports.		
1	Segment rack ¹	Riveted to segment rack supports.		
1	Segment rack support, front. ¹	Riveted to chest, left side.....		
1	Segment rack support, rear ¹	do.....		
1	Segment rack ²	do.....		
1	Separator (x=2.625) ²	Separates brake guard from chest.		
1	Separator (x=2.875) ²	do.....		
1	Shovel handle rest.....	On right side of chest.....		
1	Shovel support.....	do.....		
1	Spare connecting pole, clip.			
1	Spare connecting pole, bracket.			
1	Spare connecting pole, bracket band.	On top of chest.....		
1	Spare connecting pole, support.			
2	Staples, lock bar.....	On chest sides.....		
1	Steel angle, 1 by 1 by 0.125..	For oil can stop.....		
1	Strap fastener bar.....	Riveted on upper door.....		
2	Wheel bearing roller.....	On connecting pole socket.....		
2	Wheels, 61-inch rubber tired, complete.	See wheels under carriage for nomenclature.		

¹ For band brake model only.² For tire brake model only.

DESCRIPTION.

(Plates XIX and XX.)

The caisson, model of 1916, is a two-wheeled vehicle with armored ammunition chest for the transportation of ammunition for the 4.7-inch gun. This model is rubber tired and has either tire or band brakes.

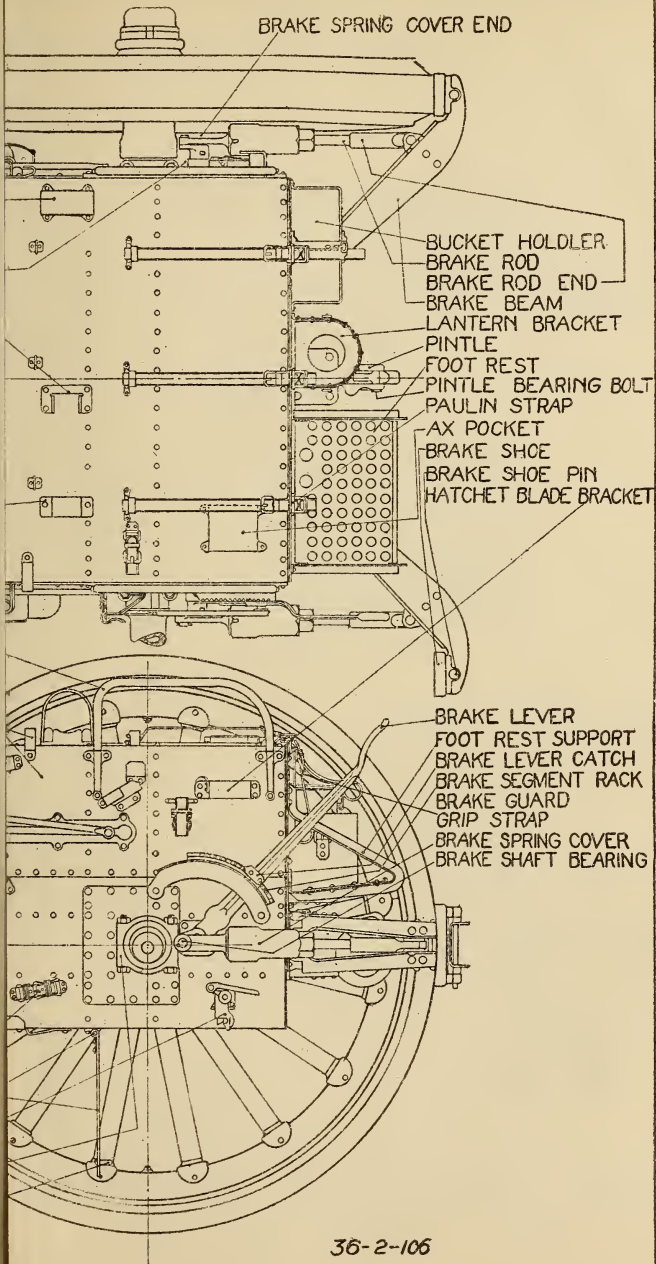
The principle parts are the wheels, axle, ammunition chest, pintle, brake, connecting pole socket, and connecting pole.

The wheels and wheel fastenings are the same as and interchangeable to those on the carriage.

The axle is fastened to the shaft by axle bearings riveted to the chest sides. The rivets passing through the intermediate plates, the middle and end diaphragm as well as the sides.

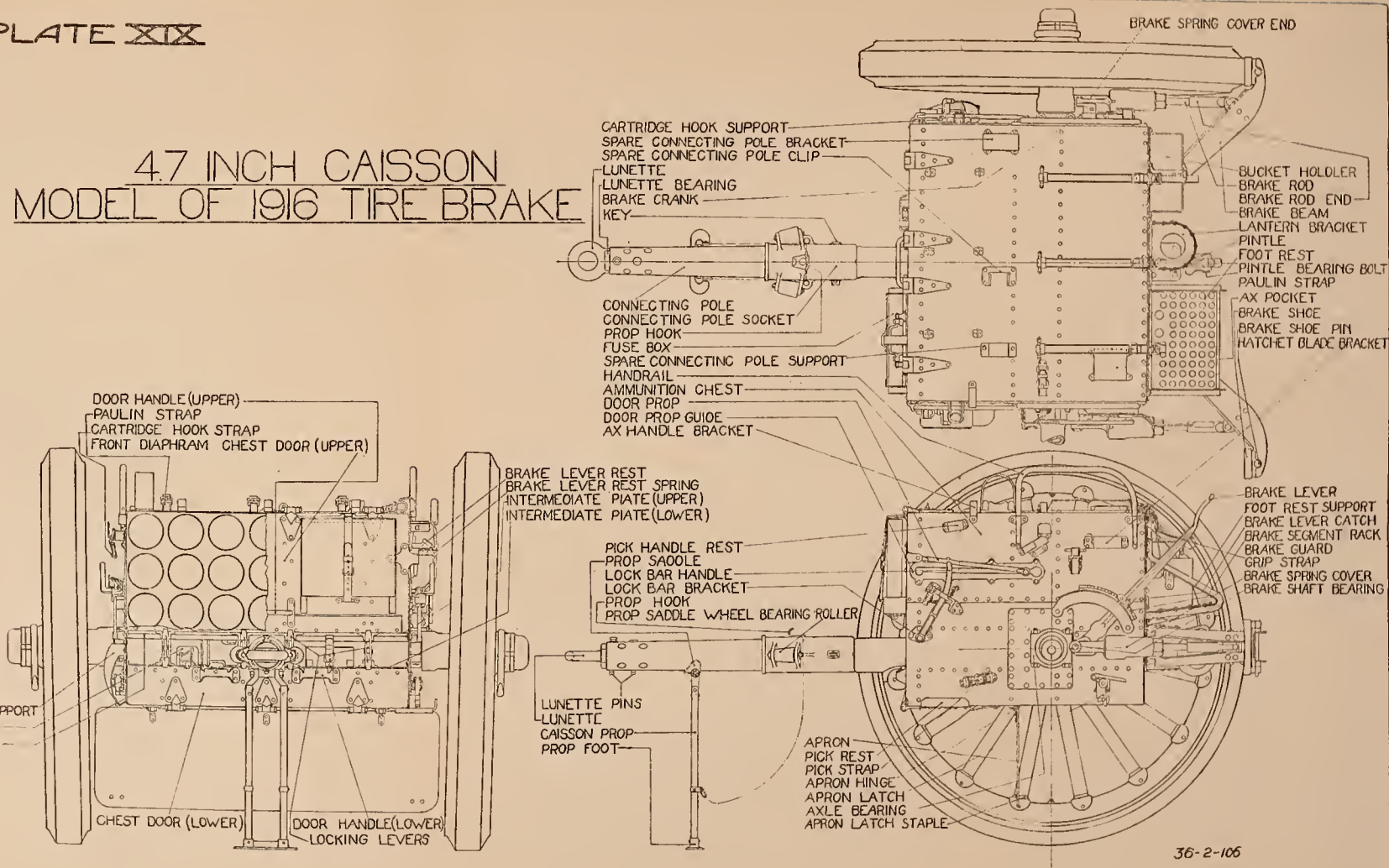
The body in two pieces of flange steel is riveted to the chest angle, forming the top, bottom, and sides of the chest. The rear of the

BRAKE SPRING COVER END



36-2-106

4.7 INCH CAISSON MODEL OF 1916 TIRE BRAKE



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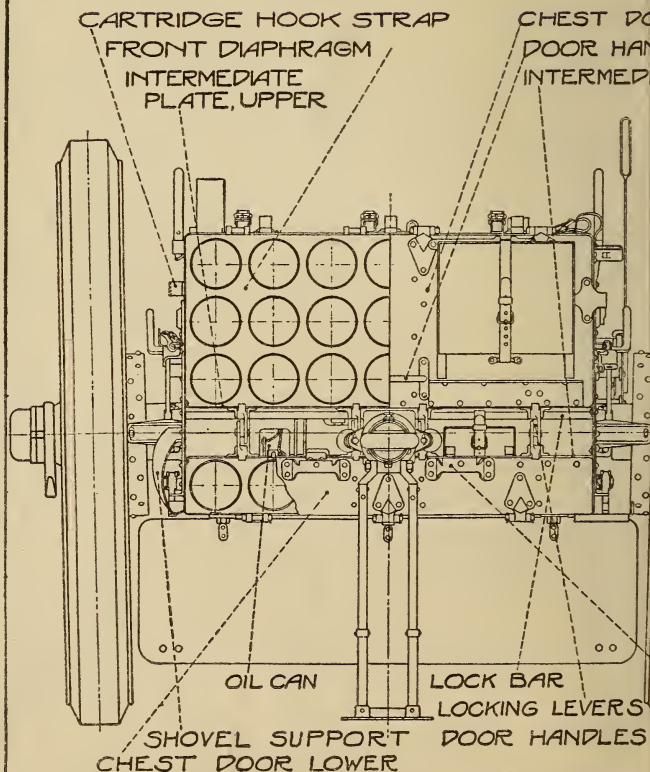
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4.7 INCH GUN CAISSON
MODEL OF 1916
 (BAND BRAKE)



chest is formed of armor plate and with the armor plate upper door and apron furnishes protection for the ammunition servers from small arms and shrapnel fires. Inside, two intermediate plates parallel to the bottom are riveted to the connecting pole socket, pintle bearing supports, reinforce plates, diaphragms, and chest sides. Upper, front, rear, and middle and lower front, rear, and middle diaphragms are riveted parallel to the rear plate. The upper ones have 21 holes each, and the lower 7 holes each, which are in exact alignment. Corresponding holes in the front and middle diaphragms have brass tubes, cut away at the top to save weight, connecting them. These connecting pieces support the front end of the cartridge case, serve to guide the projectiles and to carry empty cases. The front end of the connecting piece is turned over the front face of the flange of the perforations in the front diaphragm and forms a stop for the rim of the cartridge case. The chest doors close against the heads of the cases so that the cartridges are held firmly in position. Suitable clearances are cut in the flange of each cartridge pocket to enable the cartridge hook to get back of the rim of the case in withdrawing it from the chest. The chest doors open to the front. The lower door is hinged to the bottom of the chest, the upper to the top of the chest and by means of a lock bar, locking levers and handle, the doors are locked. The upper door is used as a shield held up at about 45° by the door prop.

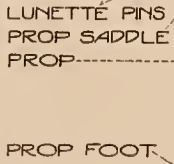
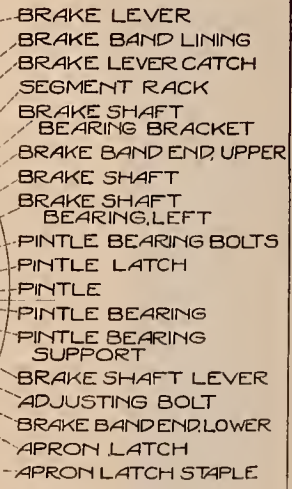
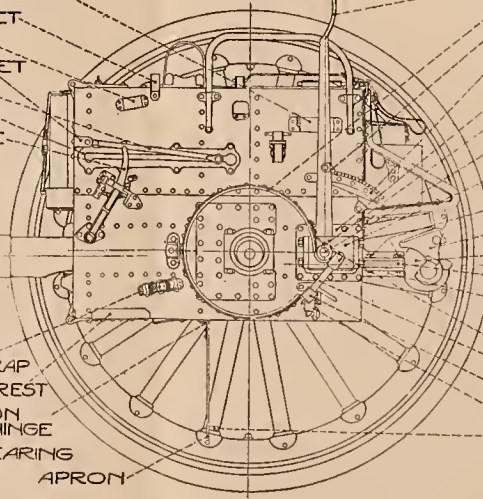
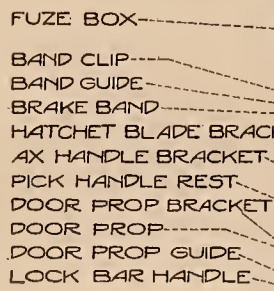
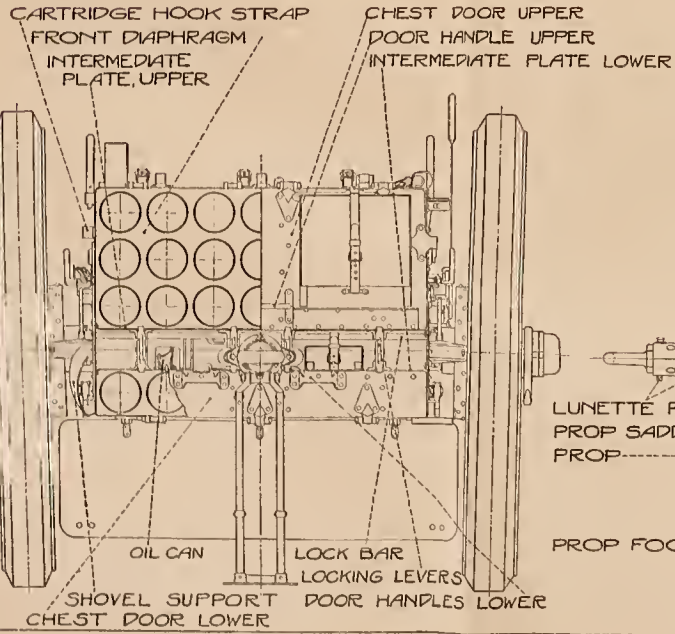
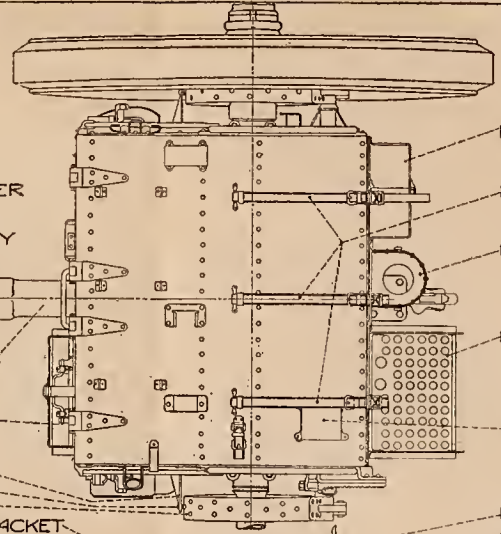
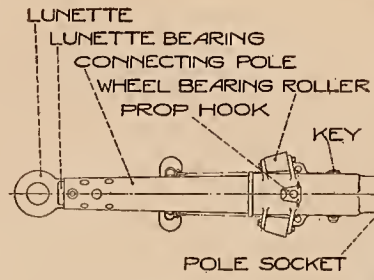
The apron of armor plate is hinged to the bottom of the caisson so that when traveling it may be swung backward against the bottom where it is held by latches on the chest sides. A padlock and key marked "*Ammunition*," that has the same kind of key as any other one marked "*Ammunition*," allows the opening of any caisson by anyone having an "*Ammunition*" key.

The connecting pole socket is riveted to the upper and lower intermediate plates, as are the pintle bearing supports, upper and lower, and the upper and lower reinforce plates. The connecting pole is secured to its socket by the connecting pole key. At the front of the connecting pole socket are two wheel-bearing rollers. The pintle bearings bolt to their supports thus furnishing means for renewing the bronze pintle bearings. The pintle latch is opened by the lunette in entering it but must be closed by hand.

The connecting pole has a body of steel tubing with its rear end finished to fit the connecting pole socket and is provided with a key bearing; its front is fitted with a lunette bearing in which a lunette is secured by two pins. On the bottom of the connecting pole is a prop saddle to which a prop is pivoted so that it may be raised and held so by a chain in traveling.

On the tire brake model, brake beam brackets are riveted to the end of the chest at the height of the axle. The brake beams are pinned to them and by the same kind of leverage system as on the carriage the brake shoes are brought to bear on the tire by pressure on the brake lever. The brake lever and segment are on the left side of the chest. The adjustment of the brake shoe is the same as on

4.7 INCH GUN CAISSON
MODEL OF 1916
(BAND BRAKE)



the carriage. *The brakes should be used only when necessary as the brake shoes bear directly on the rubber tires.*

The band brake model like the tire brake has the brake lever on the left side of the chest and is of the contracting band brake type. Pulling up on the brake lever causes the brake bands to grip the drums bolted to the wheels. A segment rack riveted to the sides of the chest allows the lever to be held at any required tension. A brake shaft sleeve connects the brake lever to the brake shaft, both turn in bronze bushings held by the brake shaft bearings, right and left. The brake shaft bearing right is riveted to the right side of the chest, while the brake shaft bearing left is held in the brake shaft bearing bracket which is riveted to the left side of the chest. The adjusting bolts are pinned to one end of the brake shaft levers, the other end screws into the brake band ends lower. The upper ends of the brake bands are slotted and have two bronze band bearings, so designed that they all fit on the brake shaft with the brake shaft lever in the slot and between the inner and outer bearings. The outer band bearings screws on the end of the shaft and is pinned there with a split pin. A band clip riveted to the side of the chest holds the band in position. Adjustment of the brake is made by removing the pin from the adjusting bolt and screwing it in or out of the brake band end lower to either tighten or loosen the brake band. The brake lining is renewable.

The top of the chest has provision made for carrying a picket rope and spare connecting pole on the front part, an ax on the left side, and at the back are straps for a paulin that also serves as a seat cushion. The left side carries the pick mattock and hatchet, the right a long handled shovel, cartridge hook, and pole socket key. On the back are riveted a bucket holder on the right side, a lantern bracket in the middle, and a foot rest on the left. Between the intermediate plates in front, an oil can is carried on the right side, a fuze box on the left, and also a spanner wrench. Handrails are riveted on each side of the box. In every battery one caisson is provided with a hand reel containing one mile of wire like that for the caisson model of 1917.

A name plate is attached to each caisson chest rear plate above the lantern. *In all reports and correspondence the caisson should be designated by the name, number, and model given on this name plate.* In requests for spare parts for repairs, etc., the parts should be asked for by the names given in the table, giving nomenclature of parts in this hand book, and the symbol of the unserviceable piece copied exactly as stamped thereon.

THE 4.7-INCH GUN CAISSON, MODEL OF 1917.

(Plate XXI.)

WEIGHTS, DIMENSIONS, ETC.

Weight of caisson, empty, without implements or ammunition.....	pounds.. 2, 053
Weight of implements carried, including spare connecting pole.....	pounds.. 180
Weight of ammunition carried.....	do.... 2, 067
Weight of caisson, completely equipped and loaded.....	do.... 4, 300
Rounds of ammunition carried.....	28
Diameter of wheels.....	inches.. 60
Width of track.....	do.... 60
Free height under caisson.....	do.... 18

NOMENCLATURE OF PARTS.

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
28	Ammunition chest connecting pieces.	Connect front and middle diaphragms.	} IV	
1	Apron.....	Hinged to top of chest door (lower).		
1	Apron extension.....	Riveted to apron.....		
4	Apron hinge (male).....	do.....		
4	Apron hinge (female).....	Riveted to chest door (lower) ..		
4	Apron hinge (male) filler.....	do.....		
4	Apron hinge (female) filler.....	do.....		
2	Apron latch (male) with pins.	Pinned to apron hinge riveted to chest bottom.		
2	Apron latch (female).....	Pinned to apron latch male...		
2	Apron hinge (female).....	Riveted to chest bottom.....		
1	Ax pocket.....	Riveted to top of chest.....		
1	Ax stop.....	do.....		
1	Ax stop and fastener.....	do.....		
1	Axle.....	do.....		
2	Axle bracket.....	Bolted to axle.....		
4	Axle bracket bushing.....	Forced into axle brackets.....		
2	Band brakes, complete, including—			
2	Brake band.....	Pinned to brake hanger and brake rod lever.		
2	Brake band lining.....	Riveted to brake bands.....		
2	Brake drums.....	Bolted to wheels.....		
2	Brake hanger and 2 pins.....	On brake hanger brackets.....		
2	Brake hanger bracket (with 2 nuts, 2 lock washers, and 2 steel plugs).	Bolted to axle brackets.....		
2	Band clip.....	Pinned to axle brackets.....		
2	Band guide.....	Riveted to brake band.....		
1	Brake lever.....	Riveted to end of brake lever bearing.		
1	Brake lever bearing.....	Bolted to brake lever pin.....		
1	Brake lever catch.....	Riveted to brake lever.....		
1	Brake lever hook.....	do.....		
1	Brake lever pin.....	Pinned to bumper (right).....		
1	Brake lever pin washer.....	On brake lever pin.....		

Nomenclature of parts—Continued.

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Band brakes, complete, including—Continued.			
1	Brake lever rod.....	Pinned to brake lever.....		
1	Brake lever rod end....	Screwed to brake lever rod....		
1	Brake lever sleeve.....	In brake lever sleeve bearing..		
1	Brake lever sleeve bearing.	Riveted to right side and bottom of chest.		
1	Brake lever stop rivet..	Riveted to segment rack.....		
2	Brake rod.....	Pinned to brake rod lever.....		
2	Brake rod end.....	Screwed to end of brake rod and pinned to brake shaft lever.		
2	Brake rod lever.....	Pinned to end of brake hanger		
1	Brake shaft.....	In brake and shaft bearing and brake lever sleeve.		
1	Brake shaft bearing.....	Riveted to left side and bottom of chest.		
2	Brake shaft lever.....	On brake shaft.....		
1	Segment rack support (upper).	Riveted to right side of chest...		
1	Segment rack support (lower).	.....do.....		
1	Segment rack.....	Riveted to segment rack supports.		
8	Belleville springs.....	On spring bolts.....		
1	Bumper (right).....	Riveted to right side of chest..		
1	Bumper (left).....	Riveted to left side of chest...		
1	Caisson prop, complete, including—			
1	Prop tube.....	} Under connecting pole.....	IV	3
1	Prop foot.....			
1	Prop eye.....			
1	Caisson prop connection....	Riveted to connecting pole....		
1	Cartridge hook support....	Riveted to left side of chest....		
1	Cartridge hook bracket....	.....do.....		
8	Carrying spring.....	On spring bolts.....		
1	Chest angle.....	Riveted around inside rear of chest.		
1	Chest body (lower plate)....	.....	
1	Chest body (upper plate)....	.....	
1	Chest door (upper).....	Hinged on front of chest.....		
1	Chest door (lower).....	.....do.....		
4	Chest guide.....	Bolted to spring support bracket.		
1	Connecting pole, complete, including—			
1	Body.....	} Keyed to connecting pole socket.		
1	Key bearing.....			
1	Lunette.....			
1	Lunette bearing.....			
2	Lunette pins, 1 front, 1 rear.			
1	Caisson prop connection			
1	Prop eye bolt.....			
1	Prop hook bolt.....			
1	Prop eye.....			
1	Prop chain.....			
1	Prop hook.....			
1	Wheel guard.....			

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Connecting pole key.....	In connecting pole key bearing	IV	3
1	Connecting pole socket.....	Riveted to intermediate plates.		
12	Diaphragm brace.....	Riveted to middle diaphragm.		
1	Door angle (for upper chest).	Stiffens edge of door.....		
2	Door angle (for lower chest).	.....do.....	
1	Door end stiffener (right).....	.....	
2	Door end stiffener (left).....	.....	
2	Door handle bar.....	On apron.....		
4	Door handle base.....	.....do.....	
7	Door hinge (female) and rivets.	.....	
7	Door hinge (male).....	.....	
2	Door prop.....	Pivoted to upper door.....		
2	Door prop bracket.....	Riveted to upper door.....		
2	Door prop guide, 1 right, 1 left.	Riveted to chest sides.....		
2	Door prop pin.....	.....	
2	Door prop rivets.....	.....	
2	Door stiffener, 2 right (upper chest).	Riveted to upper door.....		
2	Door stiffener, 2 left (upper chest).	.....do.....	
2	Door stiffener (lower chest).	Riveted to lower door.....		
2	Double tree chain eye.....	Riveted to sides of chest.....		
1	Filler plate (right).....	Reinforce for brake lever bearing.		
1	Filler plate (left).....	Reinforce for brake shaft bearing.		
2	Foot rest.....	Riveted to upper door.....		
1	Foot rest support (right).....	.....do.....	
1	Foot rest support (left).....	.....do.....	
1	Front diaphragm (upper)...	At front of chest parallel to rear plate.		
1	Front diaphragm (lower)...	At front of chest parallel to plate.		
2	Fuze box bumper.....	Riveted on upper door.....		
4	Fuze box clip.....	Riveted on foot rests.....		
4	Hand rail shank.....	Riveted to sides of chest.....		
2	Hand rail tube.....	Riveted on hand rail shank.....		
1	Hatchet blade bracket.....	Riveted to left side of chest.....		
3	Implement fastenings, complete, including—	.....	
3	Fastening base.....	.....	
3	Fastening lever.....	.....	
3	Fastening lever pin.....	.....	
3	Fastening spring.....	.....	
3	Spring catch.....	.....	
1	Spring filler (ax).....	Riveted to fastening spring on top of chest.		
1	Spring filler (wrench)...	Riveted to fastening spring on rear plate.		
1	Spring filler (hatchet)...	Riveted to fastening spring on left side of chest.		
1	Intermediate plate (upper).....	.....	
1	Intermediate plate (lower).....	.....	

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Intermediate plate reinforce angle:	.....	
1	Lower right.....	.....	
1	Lower left.....	.....	
1	Upper right.....	.....	
1	Upper left.....	.....	
1	Lantern bracket, complete, including—	Riveted to rear plate.....		
1	Lantern bracket (body).	.....	
1	Lantern bracket (bot- tom).	.....	
2	Lantern strap fasteners.	.....	
1	Lock bar (right).....	In lock bar bearing and bear- ing on connecting pole socket.		
1	Lock bar (left).....	do.....		
2	Lock bar bearing.....	Riveted to intermediate plate (upper).		
1	Lock bar handle.....	On ends of lock bars in bear- ing on connecting pole socket.		
4	Lock lever.....	In lock lever bearing.....		
4	Lock lever bearing.....	Riveted to intermediate plate (lower).		
4	Lock lever pin.....	In lock lever and lock lever bearing.		
8	Lock link, with washer and rivets.	Join lock levers and lock bars.		
8	Lock link bushing.....	Forced in lock link.....		
1	Lunette bracket.....	Riveted to rear plate.....	IV	3
1	Middle diaphragm (upper).	.....	
1	Middle diaphragm (lower).	.....	
1	Name plate.....	Riveted to center, top of rear plate.		
1	Oil can guide (right).....	Riveted to lower intermediate plate.		
1	Oil can guide (left).....	do.....		
1	Oil can latch and pin.....	Pinned to oil can latch bearing.		
1	Oil can latch bearing.....	Riveted to intermediate plate (upper).		
1	Oil can stop.....	Riveted to intermediate plates.		
1	Oil can support (right).....	Riveted to oil can guide.....		
1	Oil can support (left).....	do.....		
1	Padlock, with chain, clevis, and rivet.	Riveted to chest door (upper).		
1	Pick handle rest.....	Riveted to rear plate.....		
1	Pick pocket (needle end).....	do.....		
1	Pick rest.....	Riveted bottom of chest (rear).		
1	Pintle.....	In pintle bearings.....		
2	Pintle bearing, with bolts and nuts.	Bolted to pintle bearing sup- ports.		
1	Pintle bearing support (up- per).	Riveted to upper intermediate plate.		
1	Pintle bearing support (lower).	Riveted to lower intermediate plate.		
1	Pintle latch.....	On pintle.....		
1	Pintle latch pin.....	Through pintle and latch.....		
1	Pintle latch spring.....	On pintle latch.....		

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Pintle spring.....	Held by pintle spring guide and bolt.	IV	3
1	Pintle spring guide.....	Riveted to pintle support (lower).		
1	Pole bracket (right).....	Riveted to chest top.....		
1	Pole bracket (left).....	do.....		
1	Pole pin and split pin.....	Through connecting pole and socket.		
28	Reinforce (for ammunition chest connecting piece).	Brazed on joint on connecting piece.		
1	Rear diaphragm (upper).....	.....	
1	Rear diaphragm (lower).....	.....	
1	Rear plate.....	.....	
1	Shovel handle rest.....	Riveted to rear plate.....		
1	Shovel support.....	do.....		
1	Spanner bracket (front).....	do.....		
1	Spanner bracket (rear).....	do.....		
1	Spanner bracket plate.....	do.....		
8	Spring bolt.....	Bolted to spring support brackets.		
8	Spring bolt head.....	Screwed to spring bolt.....		
4	Spring bolt head lock.....	do.....		
8	Spring bolt washer.....	On spring bolt.....		
2	Spring support bracket (right).	Riveted to chest side.....		
2	Spring support bracket (left)	do.....		
1	Water bucket stop.....	Riveted between intermediate plates.		
3	Wing nut.....	2 for apron, 1 for door.....		
3	Wing nut pin and washer.....	do.....		
1	Wrench holder.....	.....	
2	Wheel, 60-inch, steel tired, complete, including—	.....	
2	Hub box.....	.....	
2	Hub ring.....	Outer flanges of hubs.....		
2	Hub liner.....	Forced into hub boxes.....		
2	Hub band.....	Screwed on hub box between wheel hook bushing and hub cap.		
2	Lock washer.....	On end of axle.....		
2	Wheel hooks, 1 right, 1 left.	On outside of hub.....		
2	Wheel hook bushing.....	Under wheel hook.....		
2	Hub cap.....	On end of hub.....		
2	Hub latch, complete.....	Actuate hub latch plunger.....		
2	Hub latch spring.....	.....	
2	Hub latch plunger.....	Locks hub cap in place.....		
2	Wheel oil valve, complete.	Slide in hub cap.....		
2	Oil valve spring.....	.....	
2	Oil valve rivet.....	.....	
2	Oil valve washer.....	.....	
2	Tire (steel).....	Bolted to tires.....		
16	Tire bolt, washer, nut.....	.....	
32	Spoke.....	.....	
8	Felloe segment, bent, with bolts and washers.	Bolted to tires.....		

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Wheel, 60-inch, steel tired, complete, including—Con.		IV	3
32	Spoke shoe and rivet . . .	Holds spoke to felloes		
32	Spoke shoe plate	Between spoke and felloe		
16	Carriage bolts and nuts.	Clamp spokes between hub boxes and rings.		
2	Wheel fastening, complete, including—			
2	Wheel fastening	At ends of axle		
2	Wheel fastening plunger.	.....	
2	Wheel fastening spring.	.....	
2	Wheel fastening plug.	.....	

DESCRIPTION.

(Plate XXI.)

The caisson model of 1917 is a two-wheeled vehicle with armored ammunition chest for the transportation of ammunition for the 4.7-inch gun. The two greatest changes from previous models are: The substitution of a band brake for the tire brake, and a spring support for the ammunition box.

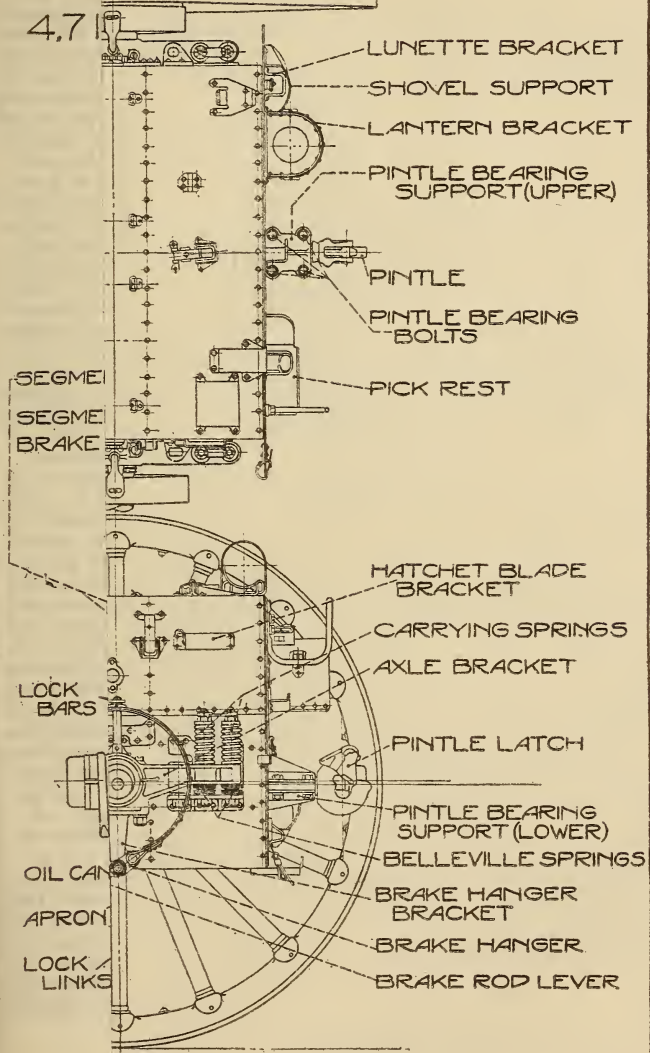
The principal parts are: The wheels, axles, spring support, ammunition chest, brakes, pintle, connecting pole socket, and connecting pole.

The wheels are 60-inch steel tired with standard hubs and fasteners.

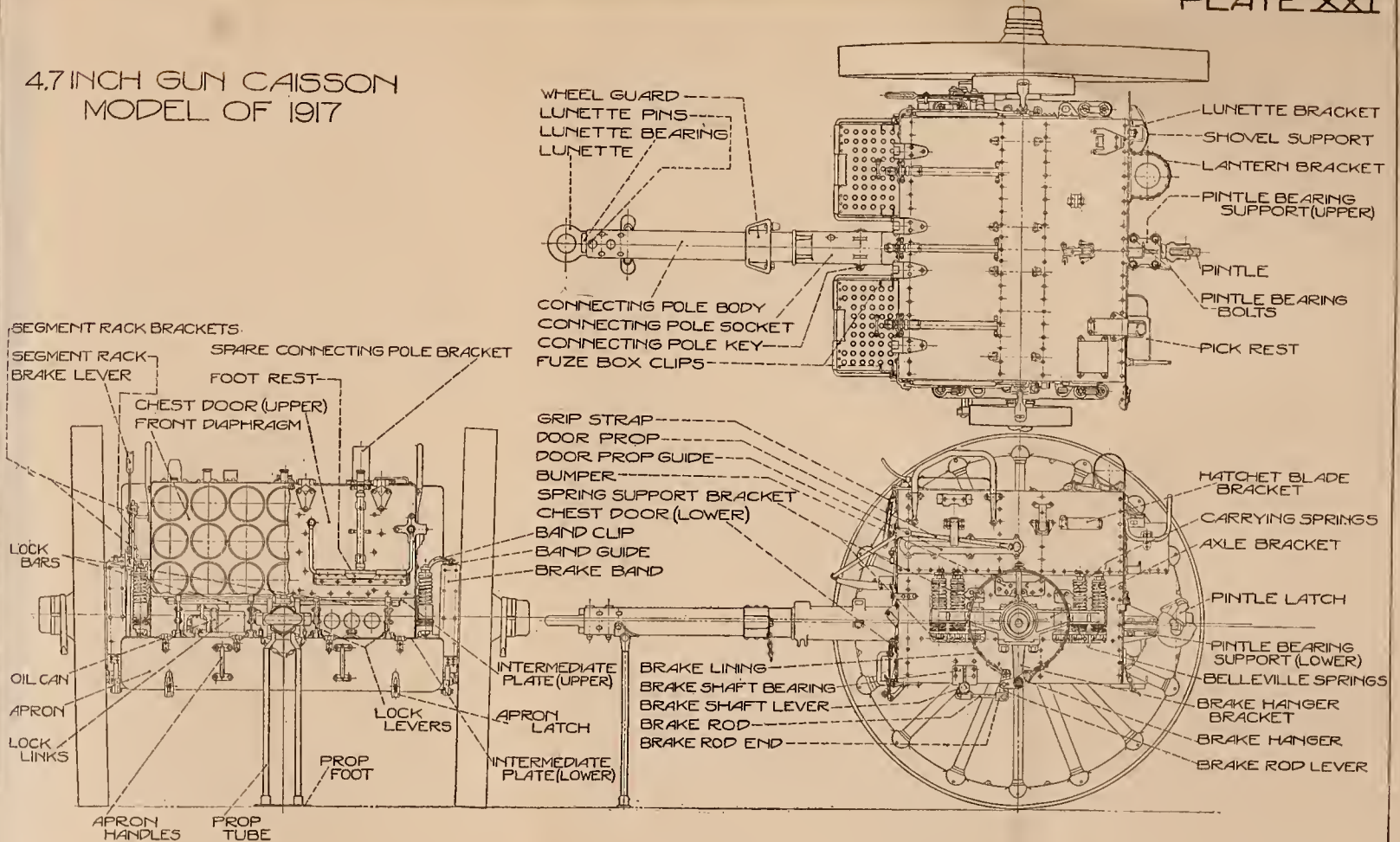
The axle is one hollow single piece of forged steel with axle brackets bolted on it. On the sides of the chest are riveted the support brackets, that, by means of chest guides and spring bolts, secure the chest to the axle brackets. Vertical shock while traveling is absorbed by the Belleville springs and support springs, while bumpers riveted to the chest sides prevent too great spring contraction.

The ammunition chest is built up of flanged steel except rear plate apron and chest doors, which are of armor plate. The body of the chest is made of two sheets of flanged steel formed to shape and joined at the sides. Three vertical diaphragms with connecting pieces provide an even distribution of the load of ammunition. Two intermediate plates parallel to the bottom are riveted one over and the other under the connecting pole socket and pintle supports. The upper door when raised is held at about a 60° angle. The lower door is made with an armor plate apron hinged to its top edge, so that when it is dropped it, with the upper door and rear plate, forms an armor plate protection.

PLATE XXI



4.7 INCH GUN CAISSON
MODEL OF 1917



MOBILITY AND
ECONOMIC DEVELOPMENT



The road brake is of the contracting band brake type and is operated from the right side of the chest by pulling up on the brake lever; this through a linkage causes the brake bands to grip the drums on the wheels. The brake bands are held in position at the top by the band clips, which are pinned in sockets in the axle brackets; at the bottom brake hangers rigidly secure one end each of the brake bands, while the other ends are fastened to the brake rod levers and through linkage to the brake lever.

The pintle is provided with a semiautomatic latch. It is supported in the pintle bearing, which is made in two parts. The pintle bearing is bolted to the pintle bearing supports, upper and lower, which are riveted to the upper and lower intermediate plates.

The connecting pole is attached to the caisson by the connecting pole socket, which is riveted to the intermediate plates, upper and lower. The inside of the connecting pole socket is tapered to take the rear end of the connecting pole. It is also designed to take the regular limber pole.

The connecting pole body is made of steel tubing, its rear end being finished to fit the connecting pole socket and is provided with a key bearing; its front end is fitted with a lunette bearing, in which a lunette is secured by two pins. A forged or cast steel collar, called the wheel guard, is fitted and riveted to the body of the pole.

Two foot rests of commercial flange steel are riveted to the chest door, upper; these also serve as handles in opening and raising the door. A lantern bracket of commercial flange steel, and fastenings for holding a pick, a shovel, a lunette, and a spanner wrench are riveted to the rear plate. To the top are riveted fastenings for holding an ax and the connecting pole, strap fastenings for the paulin and the caisson blankets. Cartridge hook and hatchet fastenings are riveted to the left side of the chest. An oil can, holding 2 gallons, is located between the diaphragms in the front of the chest on the right hand side, and the space on the left is used for the bucket holder. In every four caissons three carry lubricating oil and one hydroline. One caisson in every battery is provided with a reel for caisson model of 1917. It is riveted to the top of the caisson and contains 1 mile of field wire so arranged that the "talk" goes through all the wire. The hand crank on the right is directly connected to the reel, while the left crank has a two to one ratio for fast reeling.

By changing the connecting pole for the pole and adding the doubletree and singletrees this caisson is converted into a limber.

In the center of the rear plate near the top is riveted the name plate, containing serial number, model, where manufactured, date and inspector's initials. *In all correspondence and reports the caisson should be designated by the name, number, and model on this plate.* In request for spare parts for repairs, etc., the parts should be asked for by the names given in the table, giving nomenclature of parts in this handbook and the symbol of the unserviceable piece copied exactly as stamped thereon.

MOTORIZED EQUIPMENT.

The motorized equipment for the 4.7-inch gun battery is:

- 6 ammunition trucks.
- 8, 3-ton trucks.
- 1 artillery supply truck.
- 1 telephone and motor battery type truck.
- 3, 5-passenger motor cars.
- 1 reconnaissance car.
- 10 motor cycles with side car.
- 10, 5-ton tractors.

The ammunition truck consists of a steel body mounted on a four-wheel drive of truck chassis. The body is so designed as to accommodate original packing cases of any type of ammunition. This body will also conveniently carry five 55-gallon steel tanks for gasoline, oil, and water supply. In general, it is intended to use this body wherever an ordnance truck is required for heavy purposes.

The 3-ton truck is identical with the ammunition truck.

The artillery supply truck in motorized batteries takes the place of, and carries the equipment of, the present battery and store wagons of a field artillery battery. The equipment consists of spare parts, etc., for the 4.7-inch battery. It carries a supply of spare parts, cleaning and preserving material in the following chests with their standard furnishings, materials, etc.

- | | |
|---|--|
| <ul style="list-style-type: none"> 1 spring chest. 2 supply chests. 1 carpenter's chest. 1 grindstone chest. 1 test level chest. 1 miscellaneous chest. | <ul style="list-style-type: none"> 1 duplex chain block chest. 1 spare sights chest. 1 breech mechanism chest. 1 cleaning material and small stores chest. 1 fluid chest. |
|---|--|

A detailed list of what is carried is in the list of total battery equipment. This vehicle is used as a companion truck to the artillery repair truck whenever it may be used to carry spare parts.

The telephone and motor battery type truck consists of a four-wheel drive truck chassis having the rear wheels replaced by caterpillar tracks to increase the efficiency of the truck when negotiating bad ground. It has a wire reel mounted on the rear end of the truck. Between the reel and the driver's seat are located chests for carrying fire-control instruments. On these a number of men may also sit. This vehicle has a speed of 12 miles per hour or better.

The reconnaissance car consists of a 1-ton rear drive type of chassis having mounted upon it a steel body carrying 12 men, with the necessary storage space for fire-control instruments and signal apparatus. The special 45-horsepower engine with which this truck is equipped gives it a road speed up to 50 miles an hour when fully loaded. The car has four seats and accommodates three passengers in each seat. The front seat faces forward, the second seat back to back with it, and the third seat faces the second, and the fourth is back to back with the third. Ample leg space is allowed between

the second and the third seat. Its storage compartments include a rifle rack capable of carrying six rifles.

The 5-ton artillery tractor weighs about 9,000 pounds. It has speeds of $1\frac{1}{2}$ miles per hour, 3 miles per hour, and 6 miles per hour, respectively. It is intended for use with the 4.7-inch gun battery material. Each tractor hauls one-half of a section, or other loads not in excess of 10,000 pounds.

The five-passenger motor car is the standard Dodge touring car and is furnished by the Quartermaster Department, as are also the motorcycles with side car.

Special handbooks for the motor equipped vehicles covering their use and care in detail may be had from the Ordnance Department.

CYCLOMETER.

One carriage limber in each battery is fitted with a device which registers the number of miles traveled. This instrument, called a cyclometer, is mounted on the limber axle near the left wheel, and is composed of a star wheel and shaft actuating a train of gears, which bring figures representing 0.1 mile to 9,999.9 miles before a glass window in the usual manner of such meters.

A tally pin riveted to the wheel hub strikes the star wheel and moves it one tooth at each revolution of the wheel.

In assembling a tally pin on the wheel hub two 0.312 ($\frac{5}{16}$) inch rivet holes must be drilled in the flange of the hub box 1.3 inches apart and 0.55 inch from the end of the hub. The dowel pinhole in the axle locating the cyclometer bracket is 21.437 ($21\frac{7}{16}$) inches from the center line of the limber, 2.437 ($2\frac{7}{16}$) inches from the shoulder of the axle, and at an angle of 16° to the rear of a vertical plane through the center line of the axle.

Nomenclature of cyclometer parts:

1 bracket.	1 stop.
1 bracket strap.	1 spring.
2 bracket strap bolts.	1 tally shaft.
1 bracket bolt with nut and split pin.	1 tally pin.
1 cover.	1 washer (felt).
4 cover bolts with nuts and split pins.	1 counter.
	1 case (for counter).
	4 case screws.

PADLOCKS AND BOLT SNAPS.

The padlocks furnished for each separate vehicle, as carriage, artillery supply truck, reconnaissance car, etc., excepting the limbers, caissons, and ammunition trucks, will have keys interchangeable for all locks of that particular vehicle but differing from all others.

Limbers, caissons, and ammunition trucks are furnished with a lock, marked "AMMUNITION," which has only one key, these being universally interchangeable.

Bolt snaps for temporarily securing doors, etc., occur where no shot bolts are provided.

SIGHTS AND QUADRANTS.

The instruments provided for sighting and laying the piece include a line sight, a rear sight, a front sight, a panoramic sight, and a range quadrant.

LINE SIGHT.

The line sight consists of a conical point as a front sight and a V notch as a rear sight; the former is screwed into the locking hoop and the latter is attached to the breech end of the jacket; together they determine a line of sight parallel to the axis of the bore, useful in giving general direction to the gun.

FRONT AND REAR SIGHTS.

The front and rear sights are for general use in direct aiming. They consist of a front sight carrying cross wires and a rear sight of the peep variety. The length of the line of sight is 36.75 inches; its height from the ground with gun at 0° elevation is 53.5 inches. The sights are supported from the cradle; the peep of the rear sight is in such a position as to come opposite the eye of the gunner seated upon the left trail seat.

THE FRONT SIGHT.

The front sight complete consists of the front sight proper, the front sight holder, the front sight bracket sleeve, the front sight bracket with spring catch riveted on, and two split pins; that is, it includes all parts except the front sight bracket support.

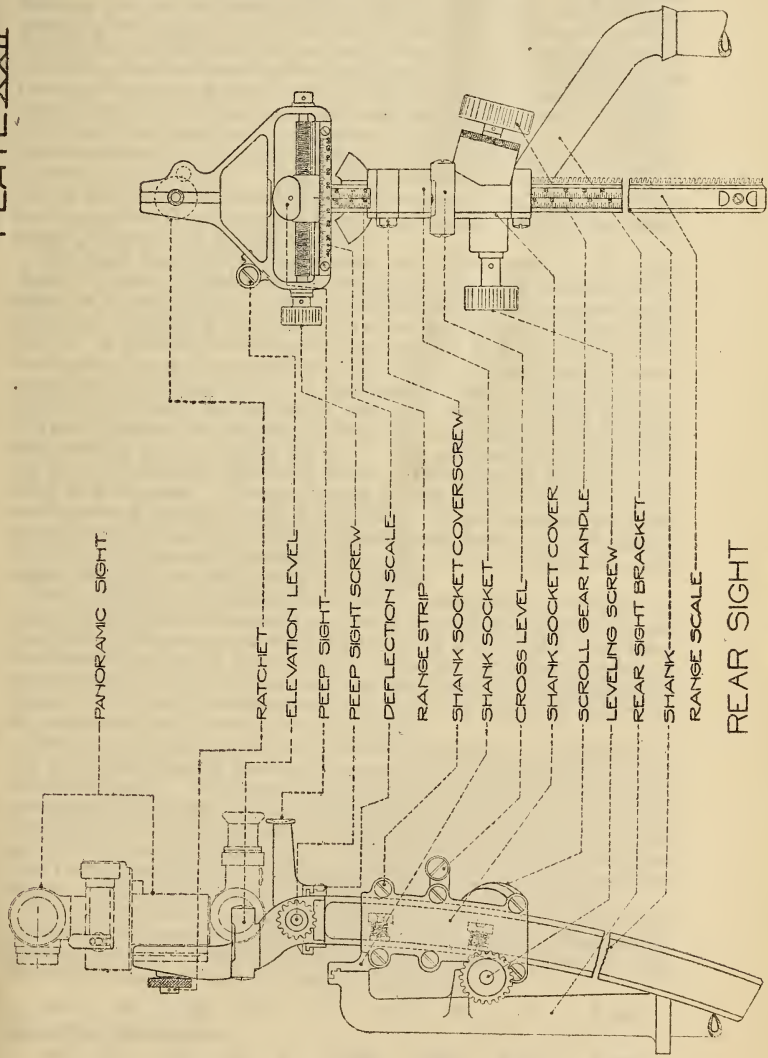
The support for the front sight bracket is riveted to the cradle in front of the shield. The lower end of the bracket fits into a socket in the bracket support. In sighting position the bracket projects from the cradle to the left, but for traveling it is arranged so that it may be swung toward the cradle to prevent its being injured. It is held in either position by the engagement of the spring catch in notches in the support socket.

The front sight proper consists of a pair of cross wires mounted in a ring. This ring is secured, with cross wires at an angle of 45° to the horizontal, in the circular hole through the front sight holder. The sight holder has the shape of an eyebolt; its shank screws into the top of the front sight bracket sleeve, which screws over the upper end of the sight bracket. When adjusted, rotation of the sight holder in sleeve or of sleeve on bracket is prevented by split pins.

THE REAR SIGHT.

(Plate XXII.)

The rear sight includes all parts, except the rear sight bracket support and the panoramic sight. The rear sight bracket support is riveted to the cradle and has a socket into which the lower end of the bracket is secured by a nut, lock nut, and split pin. The upper end of the sight bracket is provided with circular guides cut with the line of sight, gun at 0° elevation, as an axis, and upon these guides a



---PANORAMIC SIGHT.

---RATCHET.

---ELEVATION LEVEL.

---PEEP SIGHT.

---PEEP SIGHT SCREW.

---DEFLECTION SCALE.

---RANGE STRIP.

---SHANK SOCKET COVER SCREW.

---SHANK SOCKET.

---CROSS LEVEL.

---SHANK SOCKET COVER.

---SCROLL GEAR HANDLE.

---LEVELING SCREW.

---REAR SIGHT BRACKET.

---SHANK.

---RANGE SCALE.

REAR SIGHT

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socket for the shank or stem of the sight is mounted. In a support forming part of the shank socket is a leveling screw with threads engaging the segment of a worm wheel cut upon the bracket guides. A spirit level is mounted upon the shank socket. This arrangement enables correction to be made for difference of level of wheels, since turning the leveling screw revolves the shank socket and with it the sight shank about an axis parallel to the axis of the bore. A shank-socket cover is provided to strengthen the shank socket. The latest type of shank socket is made of bronze and the leveling screw support is made integral with it. The cover has two lugs on its inner surface which support springs and shoes. These shoes are pressed by the springs against the shank and force it against the walls of the shank socket, thus taking up lost motion.

The sight shank consists of a steel arc whose center is the front sight; it slides in guides in the shank socket and is moved up and down in elevation by a scroll gear seated in a boss upon the shank socket and engaging in a rack cut upon the right face of the sight shank. A German silver sight range strip fits in a dovetail slot cut in the rear face of the sight shank, the index for the scale being placed upon the upper rear corner of the shank socket. The strip has a double range scale graduated in meters for the maximum range of the gun; the smallest division is 50 meters, but smaller subdivisions may readily be made with the eye. The graduations on one scale are for the 45-pound shell and those on the other for the 60-pound shell and shrapnel. The scroll gear is held in mesh with the rack on the shank by the scroll gear spring. Large movements of the shank may be made by pulling the scroll gear handle out far enough to disengage the scroll gear from the rack and then sliding the sight shank through the shank socket by hand.

To the left side of the shank is riveted the elevation level holder, and in this holder is mounted a spirit level with axis parallel to the line joining the peep and front sights. This level enables quadrant elevations to be given by setting the sight at the desired range and moving the gun in elevation until the level bubble is brought to the center. It would give the correct elevation for the range, provided the target and gun were on the same level.

The shank is fashioned into a deflection guide and mounting for the peep sight and is prolonged upward to form a support for the panoramic sight. The peep sight guide is located in a transverse opening in the shank and is perpendicular to the shank and to the line of sight. The peep sight is clipped to this guide and is traversed along it by the peep sight screw. The latter passes through a tapped hole in the peep sight and is supported at each end in bearings in the shank. The screw is turned by a knurled head at its left end.

The deflection scale is attached to the rear face of the peep sight guide and the index for the scale is on the peep sight. The graduations are in mils. There are 45 mils upon each side of the zero, and the scale is marked from left to right as follows:

40	30	20	10	0	90	80	70	6,360
the actual mils being—								
40	30	20	10	0	6,390	6,380	6,370	6,360

thus making deflection readings on this sight uniform with those of the panoramic sight and the battery commander's telescope. The scale allows for longitudinal adjustment.

The seat for the panoramic sight is a vertical T slot into which the guide lug of the panoramic sight fits. The panoramic sight is held in place and all wear of the parts is taken up by a clamp screw, ratchet, and detent.

In firing, the sight is left in its seat.

PANORAMIC SIGHT, MODEL OF 1917.

(Plate XXIII.)

The panoramic sight is a vertical telescope so fitted with an optical system of reflecting prisms and lenses that the gunner with his eye at the fixed rubber eyepiece (RE) can bring into the field of view an object situated at any point in a plane perpendicular to the axis of the telescope.

OPTICAL SYSTEM.

The rays coming from the object are reflected downward from the rotating head prism (RHP) into the rotating prism (RP). The rotating prism (RP) rectifies the rays; after their passage through the achromatic objective lens (OL), the lower reflecting prism (LRP) reflects them in such a way that there is presented to the eye lens (EL) a reflected image, which the eyepiece magnifies. A characteristic of the rotating prism is that upon rotation about its longitudinal axis the image of the object seen through it turns with twice the angular velocity of the rotating prism. The rotating head prism and rotating prism are so mounted as to rotate about this axis, the rotating prism following the rotating head prism with one-half of the angular velocity of the latter, the image always remains as it would appear to one observing it directly with an ordinary telescope. The image formed by the achromatic objective lens (OL) would then be reversed and inverted. The rays are cross reflected to the opposite sides of the axis by the inclined faces of the lower reflecting prism, thus correcting the reversal.

The combined action of the rotating head prism (RHP), the rotating prism (RP), and lower reflecting prism (LRP), and the nature of action varying with different positions of the prisms provide for the correction of the inversion of the image. The rotating head prism (RHP) and lower reflecting prism (LRP), as shown in position on Plate XXIII, act as parallel reflectors and they without the lens system would present an erect image. The rotating prism (RP), however, inverts the rays and corrects the inversion produced by the achromatic objective lens (OL). It will be noted that the effect would be the same whether the rotating prism (RP) occupies the same position shown on the plate or be revolved 180° from that position.

The rotating head prism (RHP) must be turned through 360° to get a position of 180° for the rotating prism (RP). If the rotating

head prism (RHP) is rotated through 180° , the rotating prism (RP), and lower reflecting prism (LRP) would form reflectors set at right angles, and would give, without the lens system, an inverted image, and in conjunction with the lens system an erect image. The rotating prism (RP) in this case will occupy a position of 90° from that shown on the plate, in which position it causes no inversion but counteracts the inversion produced by the lower reflecting prism (LRP).

The instrument has a magnifying power of 4, and a field view of 10° .

THE PRINCIPAL PARTS.

The principal parts of the panoramic sight are the rotating head mechanism, the elevating device, the azimuth mechanism, the rotating prism mechanism, the counting device, the shank, and the elbow.

ROTATING HEAD MECHANISM.

The rotating head mechanism consists principally of the rotating head (RH), rotating head prism (RHP), rotating head prism holder (Y), prism holder cover (C2), elevation index support (G2), prism shield (S1), and rotating head cover (C1).

The rotating head (RH) forms a housing for its movable parts, and provides seats for the elevation worm ball socket and cap (2B and 1B), and rotating head prism holder (Y). The front opening of the rotating head is closed by the prism shield (S1) which forms a dust guard. The bottom threaded seat of the rotating head screws upon the upper end of the azimuth circle (J), and is locked in place by four rotating head retaining screws (1A). Upon the rear face of the rotating head (RH) is engraved a scale (G3) which is used for measuring the elevation of the rotating head prism holder (Y) which retains the rotating head prism (RHP), and has an index mark upon the projection coinciding with the graduations of the elevation micrometer (R1), thus measuring the angle of site.

The rotating head prism (RHP) is mounted within the rotating head prism holder (Y) between the prism support front (S), prism support bottom (T), and prism support back (X), and is secured in position by the rotating head prism spring (X1) which bears upon the prism support back (X). The rotating head prism (RHP) is protected on the right side by the prism holder cover (C2) and on the left side by the elevation index support (G2). The movement of the rotating head prism holder (Y) upon which the elevation segment (WS) is cut is accomplished by the elevation worm (E1) and the length of travel is controlled by seven brass stop rings (R2). Each ring has a small tongue, the edge of which engages at each revolution of the elevation worm (E1) with the tongue on the adjacent ring. Each ring is thus engaged in its turn until six revolutions have been made, when the tongues are all in contact, and no further movement can be made in that direction.

The prism shield (S1) is held within the rotating head (RH) by the prism shield retaining piece (3A) which is in turn secured by two prism shield retaining piece screws (2A).

The prism holder cover (C2) screws into its threaded seat located in the right side of the rotating head prism holder (Y) and is locked in position by the prism-holder cover screw (C3).

The rotating head cover (C1) screws into its threaded seat located in the right side of the rotating head (RH) and is held in place by the rotating head cover screw (S7). The exterior of the rotating head cover (C1) has two small holes for test wrench, and engravings "Field 10°" and "Power 4" are located on the exterior surface.

The elevation index support (G2) screws into its threaded seat located in the left side of the rotating head prism holder (Y) and is secured in place by the elevation index support screw (G7). The small holes in the exterior surface allow the use of a test wrench to enable the elevation index support (G2) to be screwed in place. The support retaining ring (G4) retains the elevation index support with rotating head prism holder within the rotating head and is locked in position by the supporting ring screw (G5).

The elevation index (G6) is held upon the elevation index support (G2) by the two elevation index retaining screws (G8). The arrow engraved upon the German silver piece which is dovetailed in the elevation index (G3) coincides with the graduations of the scale (G3) engraved upon the rear face of the rotating head (RH).

ELEVATION DEVICE.

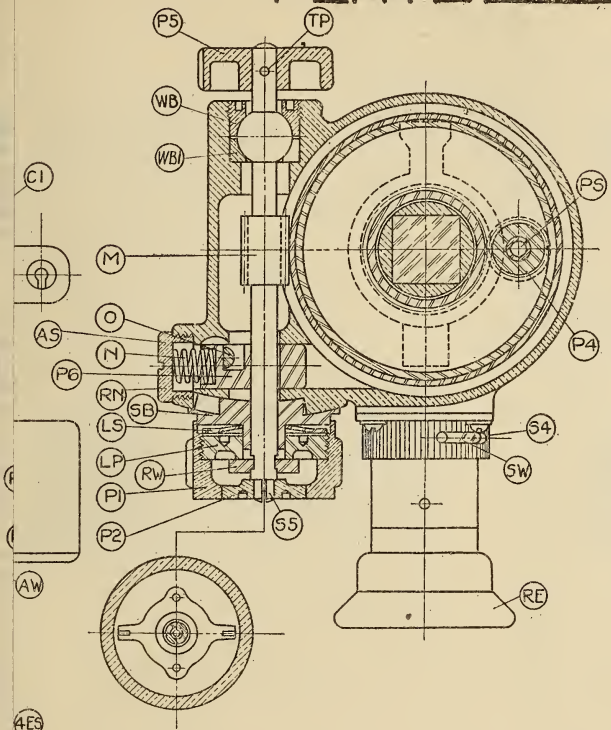
The elevation device consists principally of the elevation segment (WS), elevation worm (E1), elevation worm ball cap and socket (1B and 2B), elevation worm plunger spring and plug (S3 and E2), elevation micrometer (R1), seven stop rings (R2), and elevation index (G6).

The elevation segment (WS) is hobbled into the rotating head prism holder (Y) and meshes with the elevation worm (E1).

The elevation worm (E1) is mounted in the back of the rotating head (RH) in a ball and socket bearing (2B) which in conjunction with the elevation worm plunger spring (S3) and plunger (E2) prevents back lash between the elevation worm (E1) and the elevation segment (WS).

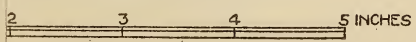
The elevation micrometer (R1) is held upon the upper slotted end of the elevation worm (E1) by the micrometer locking screw short (S2). The scale engraved upon the periphery is graduated into 100 equal divisions, numbered every 10 divisions. The upper exterior diameter of the elevation worm micrometer head is straight knurled to facilitate turning. One complete revolution of the elevation micrometer (R1) is equal to the distance between each graduation upon the scale (G3) on the rear face of the rotating head. Each graduation represents 100 mils and the scale (G3) is so planned that the line of sight is horizontal when it reads 3.

PLATE XXIII

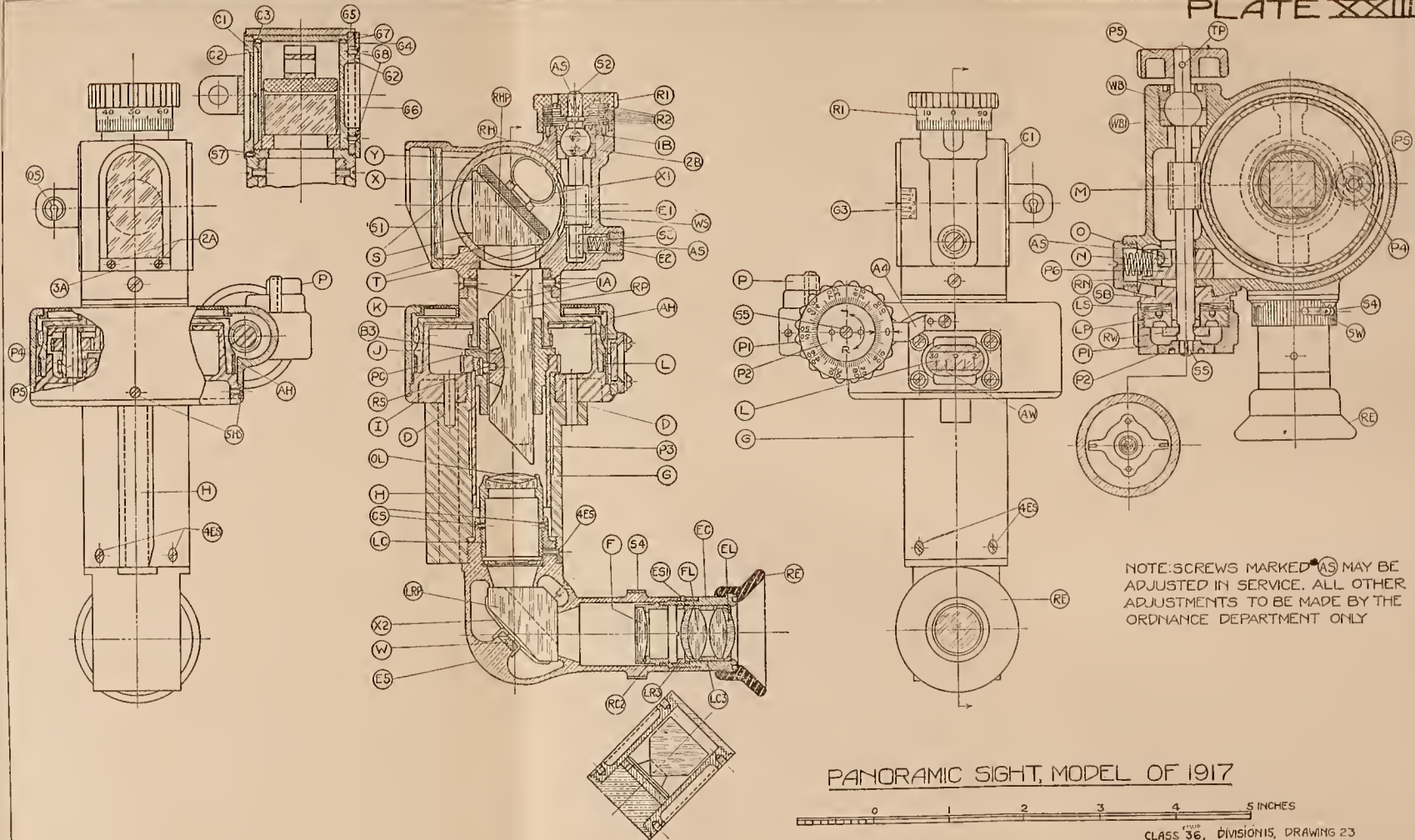


NOTE: SCREWS MARKED AS MAY BE ADJUSTED IN SERVICE. ALL OTHER ADJUSTMENTS TO BE MADE BY THE ORDNANCE DEPARTMENT ONLY

IT, MODEL OF 1917



CLASS 36, DIVISION 15, DRAWING 23



NOTE: SCREWS MARKED AS MAY BE ADJUSTED IN SERVICE. ALL OTHER ADJUSTMENTS TO BE MADE BY THE ORDNANCE DEPARTMENT ONLY

PANORAMIC SIGHT, MODEL OF 1917



CLASS '36, DIVISION 15, DRAWING 23

OPEN SIGHT.

The open sight (OS) is constructed of bronze plate bent to shape having an arm projecting out at each end, each arm containing a hole. A bronze knee is soldered to the interior of the front projecting arm over the center of the hole in such a manner as to form a sight which is used for quick sighting. The open sight (OS) is secured to the rotating head cover by two open sight retaining screws.

AZIMUTH MECHANISM.

The principal parts of the azimuth mechanism are the azimuth circle support (I), azimuth circle (J), azimuth worm (M), bearing socket (WB1), bearing cap (WB), throw-out plunger (P6), spring (N), spring plate for azimuth circle (K), azimuth circle hood (AH), azimuth micrometer (P1), azimuth index (A4), and micrometer index (P2).

The azimuth circle support (I) screws on the shank (G), to which it is pinned by two dowels (D). The rotating prism held by a screw in its holder is screwed into the supporting sleeve (P3) and then placed in the shank (G). The azimuth circle (J) rests on the tapering wall of the azimuth circle support (I), being held in place by the spring plate for azimuth circle (K), which along with the azimuth circle hood (AH) covers the rotating parts of the azimuth mechanism. The spring plate (K) furnishes the necessary friction between the azimuth circle (J) and the azimuth circle hood (AH). In the left side of the azimuth circle hood (AH) the azimuth worm (M) is held in a ball and socket bearing (WB) so that by means of a throw out cam (O) the worm (M) may be thrown out of mesh with the azimuth circle (J) for quick approximate adjustment in sighting, but is normally held in mesh by the throw out plunger (P6) and spring (N).

The German silver strip on the bottom of the azimuth circle is divided into 64 equal divisions and each even number is numbered. The numbers start at 0 and extend in a counter clockwise direction for half the circumference, then start at 0 again and continue for the rest of the circumference. As each complete turn of the azimuth worm (M) rotates the azimuth circle (J) one division, and the azimuth micrometer is graduated in 100 divisions, each division on the azimuth micrometer (P1) represents $1/6400$ of the circumference or 1 mil. Therefore an angular movement of one division on the azimuth micrometer causes a lateral displacement of so near $1/1000$ of the range that the difference is disregarded. Thus the numbers read through the azimuth circle window (AW) represent hundreds of mils, and the reading on the azimuth micrometer (P1) represents mils. On the azimuth micrometer starting from 0 in each direction, every 10th division is numbered in red or black, those in red giving left deflection and those in black right deflection. The micrometer index (P2) has two arrows, one marked "L" and the other "R" engraved on it; the "R" filled in in black and the

"L" in red. The azimuth index arrow is filled in with black. As the micrometer index (P2) is fastened tightly to the azimuth worm (M) it must turn with it, but the azimuth micrometer (P1) does not, as the locking spring (LS) and deflection locking plate (LP) prevent it from turning when the azimuth worm (M) is turned. As the azimuth micrometer (P1) may be turned independently of the worm (M) it can be so set as to be used for a counting device.

The shank (G) forms a body for the instrument and provides a seat for the azimuth circle support (I) to be doweled to and a thread at the lower end for the elbow (E5) to screw into. On the front of the shank (G) is a T lug (H) that fits into a T slot at the top of the rear sight, in which it is held by a screw with knurled head.

ROTATING PRISM MECHANISM.

The rotating prism mechanism consists principally of the rotating prism (RP), rotating prism holder (PC), supporting sleeve for rotating prism (P3), and the pinions for rotating prism and rotating head (P4). The azimuth circle (J) is geared by means of two pinions (P4) turning on the pinion shaft (PS) set in the azimuth circle support (I), to the rotating prism holder (PC) so that the angular movement of the rotating head (RH) is twice that of the rotating prism holder (PC). The rotating prism (RP) is retained in the rotating prism holder (PC) by a set screw (RS) and a block (B3) cemented to the rotating prism (RP) after the prism is ground out to fit it.

ELBOW.

The principal parts mounted in the lower end of the elbow are: The reticule (F), reticule cell (RC2), achromatic field lens (FL), achromatic eye lens (EL), eye lens cell (EC), and rubber eyepiece (RE).

The achromatic objective lens (OL) is mounted in the upper end of the objective lens cell (LC). This cell is secured in its threaded seat in the upper end of the elbow (E5) by two objective lens cell retaining screws (CS).

The elbow is screwed in the lower end of the shank (G) and secured by the four elbow retaining screws (4ES) in such a manner that its projecting arm is perpendicular to the axis of the instrument.

The lower reflecting prism (LRP) remains stationary as it is firmly pressed against seats machined in the elbow (E5) by a holder (X2) fitted to a seat at the bottom of the elbow. The tension of this holder is regulated by a wedge (W) to the required amount. Upon the right side of the elbow (E5) is an opening through which the light is thrown upon the reticule (F). This opening is covered by the window (SW) to protect the interior of the eyepiece from dust and dirt. The shutter (S4) is so designed to slide over the opening in the elbow (SW), being guided by the shutter stop screw and movement limited by the elongated slot.

The reticule (F) has two crosslines etched on its surface and is mounted in the forward end of the reticule cell (RC2) which is secured in the eye lens cell (EC) by the reticule cell retaining screw. The horizontal crossline of the reticule is graduated in mils.

The achromatic eye lens (EL) is mounted in the eye lens cell (EC) and is separated from the achromatic field lens (FL) by the lens separator (LC3). The achromatic field lens (FL) is held within the eye lens cell (EC) by the field lens retaining ring (LR3), which in turn is locked by the field lens cell retaining ring screw. The eye lens cell is secured to the elbow by the eye lens cell retaining screw (ES1).

All interior metallic surfaces exposed to the refracted light are finished with dull black baking enamel. All exposed optical elements, covers, and nonrotating joints are sealed with the litharge cement or equal. All German silver graduated surfaces are sand-blasted and lacquered.

NOTE.—Screws marked (AS) may be adjusted in service. All other adjustments to be made by the Ordnance Department only.

PANORAMIC SIGHT, MODEL OF 1917.

(Plate XXIII.)

No.	Symbol.	Name of part.
1	AH.....	Azimuth circle hood.
2	AW.....	Azimuth circle window.
3	1A.....	Rotating head retaining screw.
4	2A.....	Prism shield retaining piece screw.
5	3A.....	Prism shield retaining piece.
6	A4.....	Azimuth index.
7	1B.....	Elevation worm ball cap.
8	2B.....	Elevation worm ball socket.
9	B3.....	Block in rotating prism.
10	CS.....	Objective lens cell retaining screw.
11	C1.....	Rotating head cover.
12	C2.....	Prism holder cover.
13	C3.....	Prism holder cover screw.
14	D.....	Dowel pin.
15	EC.....	Eye lens cell.
16	EL.....	Achromatic eye lens.
17	ES1.....	Eye lens cell retaining screw.
18	E1.....	Elevation worm.
19	E2.....	Worm plunger spring plug.
20	4ES.....	Elbow retaining screw.
21	E5.....	Elbow.
22	F.....	Reticule.
23	FL.....	Achromatic field lens.
24	G.....	Shank.
25	G2.....	Elevation index support.
26	G3.....	Scale.
27	G4.....	Support retaining ring.
28	G5.....	Support retaining ring screw.
29	G6.....	Elevation index.
30	G7.....	Elevation index support screw.
31	G8.....	Elevation index retaining screws.
32	H.....	"T" lug.

Panoramic sight, model of 1917—Continued.

No.	Symbol.	Name of part.
33	5HS.....	Azimuth circle hood screw.
34	I.....	Azimuth circle support.
35	J.....	Azimuth circle.
36	K.....	Spring plate for azimuth circle.
37	L.....	German silver strip.
38	LC.....	Object lens cell.
39	LP.....	Deflection locking plate.
40	LRP.....	Lower reflecting prism.
41	LS.....	Locking spring.
42	LC3.....	Lens separator.
43	LR3.....	Field lens cell retaining ring.
44	M.....	Azimuth worm.
45	N.....	Spring.
46	O.....	Throw out cam.
47	OL.....	Achromatic objective lens.
48	OS.....	Open sight.
49	P.....	Throw out lever.
50	PC.....	Rotating prism holder.
51	PS.....	Pinion shaft.
52	P1.....	Azimuth micrometer.
53	P2.....	Micrometer index.
54	P3.....	Supporting sleeve for rotating prism.
55	P4.....	Pinions for rotation prism and rotating head.
56	P5.....	Azimuth worm knob.
57	P6.....	Throw out plunger.
58	RC ²	Reticule cell.
59	RE.....	Rubber eyepiece.
60	RH.....	Rotating head.
61	RHP.....	Rotating head prism.
62	RN.....	Spring retaining nut.
63	RP.....	Rotating prism.
64	RS.....	Rotating prism holder screw.
65	RW.....	Retaining washer.
66	R1.....	Elevation micrometer.
67	R2.....	Stop ring.
68	S.....	Prism support front.
69	SB.....	Index knob washer.
70	SW.....	Window.
71	S1.....	Prism shield.
72	S2.....	Micrometer locking screw, short.
73	S3.....	Worm plunger spring.
74	S4.....	Shutter.
75	S5.....	Micrometer locking screw, long.
76	S7.....	Rotating head cover screw.
77	T.....	Prism support bottom.
78	TP.....	Taper pin.
79	W.....	Wedge.
80	WB.....	Bearing cap.
81	WB1.....	Bearing socket.
82	WS.....	Elevation segment.
83	X.....	Prism support back.
84	X1.....	Rotating head prism spring.
85	X2.....	Lower reflecting prism holder.
86	Y.....	Rotating head prism holder.

THE RANGE QUADRANT.

(Plate XXIV.)

In this carriage the elevating and traversing mechanisms are entirely independent of each other, and the laying of the gun may be accomplished for indirect aiming by assigning to one gunner the laying for direction and to a second that for range. The gunner on the left of the piece using the open or panoramic sight lays for direction only, while the gunner on the right trail seat gives elevations by means of the range quadrant.

The range quadrant consists of the quadrant bracket, rocker, body, scroll, gear, range disk, and range and cross levels with suitable leveling screws.

A quadrant-bracket fastening riveted to the right side of the cradle has dovetailed guides in which the quadrant bracket fits and is held by a spring catch. Two bracket fulcrums screwed into arms on the bracket project into bearings in the ends of the rocker, assembling the latter to the bracket and at the same time permitting it a motion of rotation about an axis joining the centers of the bracket fulcrums or trunnions. As assembled, this axis of motion is parallel to the axis of the gun. A projection below the rear end of the rocker forms a seat for a leveling screw, the axis of which is in a plane perpendicular to the axis of the gun. The knurled head of this screw projects to the right and its threads mesh in the segment of a worm wheel cut on the quadrant bracket. This leveling screw is thus arranged to rotate the rocker on its trunnions and, in conjunction with the cross level mentioned below, enables the quadrant to be brought into a vertical plane parallel to the axis of the gun. This construction is necessary to correct for difference of level of wheels and to give true quadrant elevations. At the front end of the rocker is the seat for a fulcrum pin, which forms the center of motion of the quadrant body. At the rear end of the rocker a curved arm projects upward which has circular racks cut on its front and rear edges. This curved arm passes through a slot in the body and the centers of the racks coincide with its center of motion.

The body, as stated above, is pivoted on the rocker. Its rear end affords a housing for the quadrant elevating gear and a seat for the range disk. The elevating gear consists of a scroll gear, meshing with the rear circular rack of the rocker. The scroll gear is actuated by a knurled handwheel, which projects upward and to the rear. Turning the handwheel rotates the body on its fulcrum pin, moving its rear end up or down on the curved arm of the rocker. The scroll gear is pressed against its rack by a spring; large changes of position of the quadrant body may be made by pulling the handwheel out to disengage the gear from the rack and then moving the body by hand to the desired position.

The range disk is assembled on a steel shaft seated in the quadrant body; this shaft carries a pinion which meshes with the front circular rack on the curved arm of the quadrant rocker. The range disk is

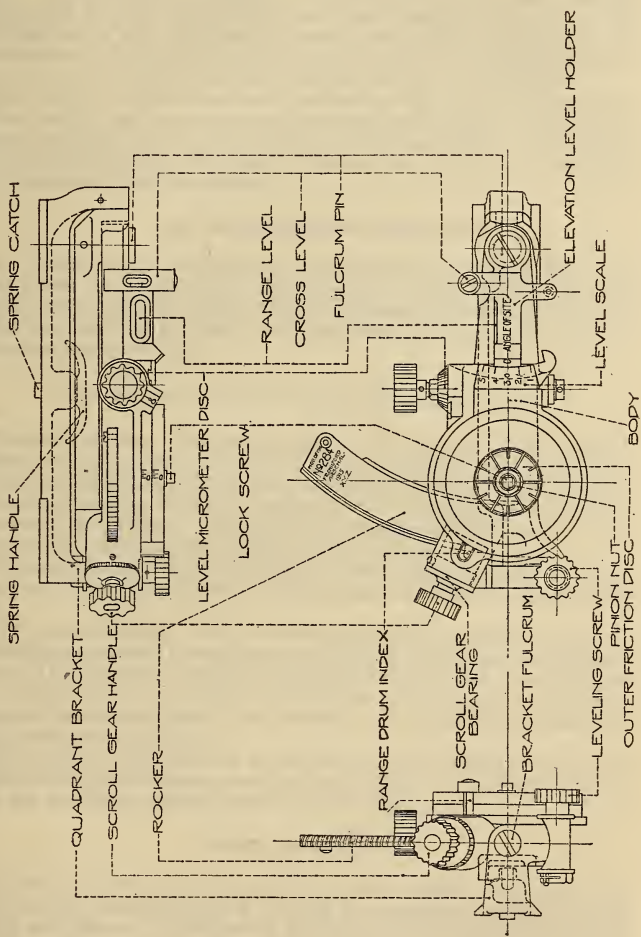
held on the shaft between two steel friction disks. The outer friction disk on quadrants is split radially and has a serrated edge. This combined with the slight spring allowed in the washer forms an adjustable yet secure lock for the range disk. A nut screwed on the shaft clamps the disks in position, and a lock screw in the end of the shaft prevents the nut from unscrewing. The inner friction disk is connected to the shaft by lugs projecting into a slotted collar. A spiral spring, the tension of which serves to take up any lost motion in the arrangement, is connected at its outer end to the inner friction disk by a pin. It is wound around the hub of the body and secured to the hub in a slot cut to receive it.

The face of the range disk, which is visible on the right side of the quadrant, is graduated in meters for ranges up to the maximum range of the gun. The disk for the 4.7-inch gun has two range scales, one for the 45-pound shell and the other one for the 60-pound shell and shrapnel. The caliber of gun for which the range disk is made is engraved on the face of the disk.

The least division is 100 meters below 500 meters and 50 meters above 500 meters, and the scale is dimensioned at each 500 meters. Divisions smaller than 50 meters may be readily made with the eye. The range disk is always in gear through its shaft and pinion with the rack on the curved arm of the rocker, and any change in position of the quadrant body with reference to the rocker arm is registered by the disk.

The elevation level holder is seated on the forward part of the body, with its front end pivoted on the fulcrum pin of the latter. Its rear end is finished with a segment of a worm wheel, cut with the fulcrum axis as a center, which meshes with a vertical micrometer screw seated in the body. The amount of the relative motion of the level holder and body is measured by a level scale, consisting of an ordinary circular scale dovetailed in the body with an index on the elevation level holder supplemented by a level micrometer disk on the upper end of the micrometer screw. The level scale is graduated in sixty-fourths of the circumference, and one complete turn of the screw moves the level holder through one of these divisions. The level micrometer disk on the head of the micrometer screw has 100 divisions, so that one of these divisions corresponds to one mil. The divisions of the circular scale are marked 2, 3, 4, and 5, and in connection with the level micrometer disk are read 200, 300, etc., plus the indication of the latter. The 3 or 300 mark corresponds to the mean or zero position of the elevation level holder. The level holder is fitted with two spirit levels of a sensitiveness of 0.1 inch, which equals five minutes of arc. The longitudinal or range level is located so that its axis is parallel to the axis of the gun when the level scale is set at 3 and range disk at zero.

The axis of the transverse or cross level is perpendicular to that of the range level and also to the plane of motion of the quadrant body. The cross level in connection with the leveling screw enables the quadrant rocker and body to be kept vertical. The range level in connection with the elevation level holder and its level screw is used as a clinometer to correct the range disk readings for angle of



RANGE QUADRANT

site; in connection with the quadrant body it is used as the quadrant level. For purposes of reference, these levels are designated as the cross level and the range level, and their respective screws as the leveling screw and micrometer screw; the scale pertaining to the latter screw is called the level micrometer disk. The range level is also referred to at times as the quadrant or angle of site level.

The range quadrant remains in position on the cradle during firing. When not in use it is removed from the cradle and carried in the range quadrant case on the rear face of the main shield. To remove range quadrant from the cradle, release the spring catch and slip the quadrant from the support.

USE OF SIGHTS AND QUADRANTS.

By construction and method of mounting with longitudinal and cross levels on the rear sight, the panoramic sight forms a horizontal angle measuring instrument. These angles are read directly from the deflection scale of the sight in units, mils, equivalent to $\frac{1}{6400}$ of a complete circle, or 360° .

USE OF THE PANORAMIC SIGHTS, MODEL OF 1917.

For direct aiming.—Set the rear sight at the required elevations and correct for difference of level of wheels; set off the desired deflection on the azimuth circle of the panoramic sight; bring the crosslines of the sight upon the target by means of the elevating and traversing devices of the carriage. For imparting the approximate initial direction the line sight may be used with advantage.

In using the model of 1917 sight for direct fire care must be taken that the rotating head be set at 300 mils and the deflection mechanism at 0.

For indirect aiming.—Set the rear sight at the required elevation and make correction for difference of level of wheels; set the azimuth circle of the panoramic sight at the deflection ordered. Lay the gun for deflection by directing the vertical line of the panoramic sight at the auxiliary aiming point, the elevation of the gun being given by using the range quadrant.

The angle of deflection to be set off on the azimuth circle of the panoramic sight is the same as the angle made by joining the target and the auxiliary aiming point with the sight.

RANGE QUADRANT.

To give quadrant elevations with the range quadrant.—Set the range disk for the desired range by turning the quadrant elevating hand wheel and correct for difference in level of wheels; correct for angle of site on the scale of the level holder; bring the bubble of the range level to the center by elevating or depressing the gun. The gun will then have the elevation (corrected for angle of site) corresponding to the range.

CARE OF SIGHTS AND QUADRANT.

Whenever convenient, and especially when in garrison and not in use, the front and rear sights with the range quadrants and panoramic sights should be removed from the carriages and kept in some dry place, as in the barracks' storeroom or office.

CARE OF FRONT AND REAR SIGHTS.

For traveling, the front sight is covered by the duck cover supplied for the purpose, and by means of the spring catch at the base of the bracket it is turned 105° from its firing position and locked to the front sight bracket support. The sight shank is withdrawn from the shank socket, covered with the cover for rear sight shank, and placed in the packing provided for it in the trail of the carriage. A duck cover, called the cover for rear sight bracket, is provided to protect the surfaces of the shank socket and should be slipped over the socket when the shank is removed.

All parts of the sight shanks and shank sockets should be kept clean, free from rust, and lightly oiled. When stored or not used for short periods, they should be thoroughly cleaned and well coated with light slushing oil. Should any part become rusted, it should be carefully cleaned by softening the rust with coal oil and rubbing with a soft pine stick.

In handling all parts of the sights care must be exercised to avoid injuring them by dropping, striking them upon or with other parts, etc. The front sight bracket *must not* be used by the cannoneers as a handle to assist in mounting upon or dismounting from the carriage.

To clean the joint between the bracket and the shank socket, drive out the pin from the end of the leveling screw and remove the leveling screw. Disassemble the bracket from the shank, clean all parts and oil them with sperm oil. Assemble in the reverse order.

Oil the leveling screw from time to time through the oil hole provided in the sight bracket.

For instructions for the replacement of level vials see instructions given under the heading "Care of range quadrant."

CARE OF THE PANORAMIC SIGHT, MODEL 1917.

These sights are delicate instruments, and must not be subjected to any rough usage, jars, or strains. In firing they remain in position on the carriage; in the field when not in use they are kept in the padded leather cases prepared for them on the rear of the main shield.

To obtain satisfactory vision, the glasses must be perfectly clean and dry. The T lug on the sight and the slot forming its seat should be kept lightly oiled as a preventive of rust. The worm and worm rack should be oiled with vaseline. When dust accumulates on the pointers it should be removed by a fine camel's hair brush in the hands of an experienced person.

To clean the rotating head window and the front face of the rotating head, do not remove the rotating head window from the window cell.

In panoramic sights of serial numbers after 752 the exposed optical elements and all nonmoving joints are sealed and no attempt should be made to remove them.

CARE OF RANGE QUADRANT.

The directions for the care of the range quadrant are practically the same as those for the care of the various sights. The parts should be kept clean, free from rust, and bearings lightly oiled. When stored they should be coated with light slushing oil.

To clean the micrometer screw, remove the screw in the center of the micrometer dial, turn the micrometer screw until the dial is forced off; drive (away from gun) the taper pin holding the screw bushing. Pull out the screw bushing, clean, oil with a heavy oil, and assemble in the reverse order and adjust.

Extra glass level vials assembled in brass tubes, to replace broken vials in sights and range quadrants, except for the range levers of quadrants, will be issued on requisition. In case the range level of the range quadrant requires replacement, the range quadrant will be turned in to an arsenal designated by the armament officer.

Only ordinary tools, such as a hammer and a punch or a piece of wire, are required for the removal of pins from level caps in order to replace vials. All pins on level caps are driven in toward the center of the instrument. They should be driven out in the opposite direction. Four radial screws in the vial tubes are used for adjusting the tubes in their holders.

ADJUSTMENT OF SIGHTS AND QUADRANT.

The sights are correctly adjusted when, at zero elevation and deflection, the line of sight is parallel to the axis of the bore.

The range quadrant is correctly adjusted when, with the range disk set at zero, level scale set at 300, and axis of gun horizontal and corrected for difference of level of wheels, the level bubble of the range level stands in the center of its vial. In adjusting sights, the panoramic sight should first be corrected. If the rear sight is adjusted first, it will require readjustment if the subsequent adjustment of the panoramic sight causes a change in position of the rear sight range strip.

ADJUSTMENT FOR BACKLASH OF PANORAMIC SIGHT, MODEL OF 1917.

Provision for automatically taking up the backlash that may occur between the azimuth worm and azimuth circle and also between the elevation worm and its segment is made in their design. So if any backlash should occur its adjustment should be made by the Ordnance Department.

TO ADJUST THE PANORAMIC SIGHT, MODEL OF 1917.

Direct the panoramic sight by means of the azimuth micrometer and rear sight scroll gear until its line of sight is parallel to the axis of the bore. The method of determining when this condition of parallelism exists is described hereafter. Without disturbing the direction of this line of sight move the azimuth micrometer of panoramic sight and the range strip of the rear sight until the zero

marks come opposite their respective indices. The azimuth micrometer may be moved after loosening the locking screw in the end of the worm. This locking screw may be loosened by the combined teat wrench and screw driver issued for the purpose. If the azimuth micrometer can not be readily removed, grasp the sight by the azimuth micrometer, release the worm from the worm gear of the azimuth circle, and gently tap the exposed end of the worm with a small piece of wood or soft metal.

To locate the index opposite the zero of the scale, loosen the four screws that hold the movable index cover in place and move this cover until the index is properly located; then tighten the screws. Movement of the range strip of the rear sight is made possible by a slot in the shank in which the range strip screw can be moved when the nut has been loosened.

TO ADJUST FRONT AND REAR SIGHT.

Set the rear sight shank at zero elevation and move the peep sight and the front sight until the line of sight is parallel to the axis of the bore. The method of determining when this condition of parallelism exists is given below. Now shift the deflection scale on the rear sight, after loosening the two screws, until its zero is opposite the index on the peep sight.

Movement of the front sight is accomplished by turning the front sight bracket sleeve, after first removing the split pins.

TO ADJUST THE RANGE QUADRANT.

Elevate or depress gun until its axis is horizontal, correct for difference of level of wheels, set the level scale of the quadrant at 300, then turn the quadrant handwheel until the range level bubble is centered. Now turn the range disk of the quadrant until its zero coincides with the index. The range disk is held between two friction disks secured by a nut and lock screw and it is only necessary to unscrew these to release the disk and correct its position. To test the horizontality of the gun, use the testing level issued for that purpose. This level has two arms perpendicular to each other, and a level vial is inserted in each arm. As the faces of the breech and the muzzle are perpendicular to the axis of the bore, the horizontality of the axis of the bore may be determined by placing one of the arms of the testing level against the face of the breech or muzzle and elevating or depressing the gun until the bubble in the level of the other arm is in the center. Then apply the other arm to the same face, and the bubble in the first arm should also be in the center of its vial. If not, the testing level requires adjustment.

VERIFICATION OF PARALLELISM OF LINES OF SIGHT AND AXIS OF BORE.

The adjustment of the sights and range quadrant is of such importance and should be verified so frequently that battery commanders will find it advantageous to make permanent arrangements for such

verification. The leveled supports constituting the carriage emplacement should preferably be of stone. The site of the target (fig. 1) should be prepared, and the exact locations of the target and horizontal reference points permanently marked. If these arrangements

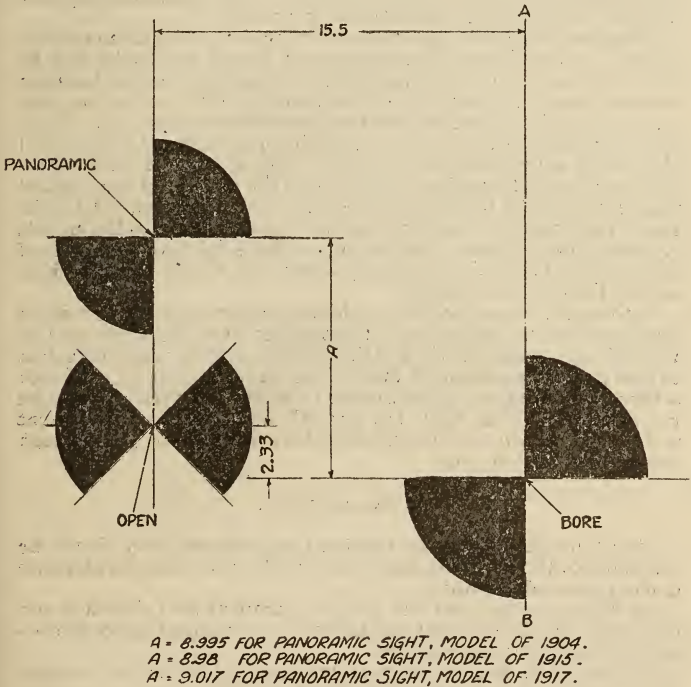


FIG. I.

are properly made, subsequent verifications of sights and quadrants will become a simple matter.

A target of dimensions given in figure 1 is placed in a vertical position perpendicular to the line of sight at such a height that the point "bore" is at the same height as the axis of the bore of the gun.

The verticality of the target is assured by a plumb line attached at A, coinciding with the vertical line A B.

The carriage is placed with the wheels and trail resting upon solid supports of wood or stone, the surfaces of which have been carefully leveled so as to bring the axle axis horizontal. Now direct the gun so that the prolongation of the axis of the bore, as determined by the bore sights, pierces the target at the proper point; the lines of sight of the open and panoramic sights are then adjusted in direction by the means explained above until they pierce the targets in the points marked, respectively, "open" and "panoramic."

The axis of the bore is determined and prolonged by means of bore sights. In the absence of such means a breech-bore sight may be made from an empty cartridge case from which the primer has been removed; a piece of paper should be pasted over the primer seat and a pinhole made in its exact center to serve as a peep sight. If the cartridge case does not completely fill the bore, it should be shimmed all around with tissue paper until it does so. For a muzzle-bore sight use should be made of the traces of the horizontal and vertical planes containing the axis of the bore, which are marked on the muzzle of the gun. Fine threads or hairs stretched across the muzzle to coincide with these lines form a good bore sight, and the ends of such threads may be conveniently fastened to a cloth strap buckled around the muzzle of the gun.

In the field, where from lack of time or proper facilities the method just given can not be followed, the adjustment of the sights may be verified by bringing the lines of sight at zero elevation and deflection to bear upon some sharply defined point of a distant object. At such a range (for instance, 2,000 meters or more) the parallax may be neglected, and if the sights are correctly adjusted the lines of sight and the prolongation of the axis of the bore will sensibly pass through the selected aiming point.

ADDITIONAL TESTS.

After the sights and range quadrant are adjusted they should be subjected to the following tests to insure their accuracy at extremes of elevation and azimuth:

(a) With carriage level and gun and sights at zero elevation and deflection, the lines of sight and axis of bore prolonged pierce the target (fig. 1) in the proper points.

(b) The gun is then moved to its maximum elevation; as the sight elevation is altered, the lines of sight should follow the vertical lines through the same points of the target (fig. 1).

(c) With conditions as in (a), the gun is moved upon the carriage to its extreme positions in azimuth; as the sight deflections are now altered, the lines of sight should follow the horizontal lines through the same points on the target (fig. 1).

(d) With conditions as in (a), the range quadrant disk registers 0. As the gun is elevated and the sight elevation changed to bring the line of sight to bear upon the proper point of the target (fig. 1), the readings of the range disk, quadrant leveled, should agree at all ranges with those of the elevation scale of the sight.

By construction and assemblage the sights, if correctly adjusted, should fulfill the above conditions with substantial accuracy. If error be noted, a report of the facts of the case with the cause, if known, should be made to the ordnance officer charged with the repair of the matériel for his information and action.

SPARE SIGHTS AND QUADRANT.

To each battery is issued one set of spare sights, consisting of one front sight complete, one rear sight complete, one panoramic sight, and one range quadrant. These parts are carried in a special chest on the artillery supply truck. One set of bore sights (consisting of one breech and one muzzle bore sight) and one level for use in adjusting sights, etc., are also issued to each battery.

ADJUSTING INSTRUMENTS.

A complete detailed description of the method of disassembling and adjusting the different instruments is given in Ordnance Office Pamphlet No. 1795, Instructions for the Care, Preservation, Repair, and Adjustment of Instruments for the Fire-Control Systems for Coast and Field Artillery. Attention is invited to General Orders, No. 47, War Department, March 24, 1905, with reference to the care and repair of panoramic sights, battery commander's telescopes, and range finders.

No disassembling of instruments except as prescribed herein will be permitted. The disassembling of telescopic instruments allowed herein must be done only in the presence of a commissioned officer. Disassembling as permitted in pamphlet 1795 must be done only by officers or employees of the Ordnance Department.

TARGETS.

The description and allowances of targets and accessories for mobile Artillery are given in Ordnance Office Pamphlet, Form No. 1994, "Mobile Artillery Targets and Accessories."

GENERAL INFORMATION.

PAINTING ARTILLERY MATÉRIEL.

The paint issued for this purpose is of olive-drab color, put up in 5-pound cans ready for use, and is applied to both wood and metal parts. If the paint is too thick, turpentine should be used as a thinner, but not to greater extent than 2 per cent by volume.

All steel and iron nonbearing surfaces will be painted, including that portion of the underside of the gun between the clips. Wearing and bearing surfaces, teeth of gear wheels, elevating screws, piston rods, cylinders, counter recoil springs, and interiors of spring cylinders will not be painted.

Articles which can be easily cleaned and repainted may be immersed in the solution. It is forbidden to immerse articles which can not be entirely repainted; for example, ammunition chests, the joints and some parts of the interior of which it would not be practicable to repaint.

All parts to be painted should be free from dirt or grease. They may be washed in a liquid made by dissolving one-half pound sal soda in 8 quarts of warm water, then rinsed in clean water, and wiped thoroughly dry.

Where the matériel is in fair condition and only marred in spots, the marred places should be primed with olive-drab paint, second coat, and permitted to dry. Then the whole surface should be sandpapered with No. 1½ sandpaper and a coat of paint applied and allowed to dry thoroughly before use.

Where the matériel is in bad condition all parts should be thoroughly sandpapered with No. 2½ sandpaper, be given a coat of paint, and be permitted to dry for at least 24 hours; then sandpaper with No. 00 sandpaper, apply a finishing coat, and permit the parts to dry thoroughly before use.

In general, two coats of paint per year will be sufficient to keep the matériel in good condition. After repeated painting the paint may become so thick as to scale off in places or give an unsightly appearance. It may then be removed for repainting, as follows:

Dissolve 1 pound of concentrated lye, powdered form, in 6 pints of hot water, and slake in enough lime to give the solution the consistency of paint. Use the solution freshly mixed and apply to the parts where paint is to be removed with a brush or with waste tied to the end of a stick. When the solution begins to dry on the surface use a scraper to remove the old paint, and complete the cleaning of the surface with cloth and water. If one application is not sufficient to loosen the paint, apply a second coat. Before painting wash the surface with sal-soda water, rinse with clean water, and then wipe thoroughly, as described above.

OILS FOR ARTILLERY MATÉRIEL.

For the service, cleaning, and preservation of this matériel the Ordnance Department issues hydroline oil, lubricating oil (or engine oil No. 1), clock oil, sperm oil, coal oil, neat's-foot oil, and light slush-ing oil. Each of these oils is suited for the particular purpose for which it is issued, as stated below, and care should be taken that it is not used for other purposes.

The hydroline oil is for use in the recoil cylinders of the carriages and *for no other purpose.*

The lubricating oil (or engine oil No. 1) will be used exclusively in all oil holes of the matériel, and in lubricating such parts as wheels and axles, gun and cradle slides, pintle bearing, elevating and traversing mechanisms, exterior of cylinders, brake bearings, hinges, different surfaces of breechblocks, threads of breech recess, etc.

Clock oil should be used on the spindle and all bearings of the battery commander's telescope, bearings of the panoramic sight, and fuze setters, and on the observation telescope, field-artillery plotter, sextant telemeter, and worms of the rear sight. In all cases clock oil should only be used when the instruments mentioned are disassembled for cleaning. When used it should be applied by dropping from the end of the dropper attached to the end of the cork.

The sperm oil is a lighter lubricant than the engine oil No. 1, and may be used on the gears of sights, fuze setters, parts of revolvers, etc.; engine oil No. 1 may also be used on such parts.

Coal oil is used by the Ordnance Department for cleaning purposes. In the field it may be used for lanterns. Coal oil for general illuminating purposes is furnished by the Quartermaster's Department.

Neat's-foot oil is used for the care and preservation of all leather equipment, and should be applied as follows: After leather has been washed in water (lukewarm preferred) with Castile soap, allow to dry in the shade till nearly dry. Then apply neat's-foot oil moderately with a sponge or rag, rubbing in well till the leather is soft and pliable.

Light slushing oil is prescribed for use in the protection and preservation of all bright or unpainted surfaces of steel or iron on all parts of the equipment when the matériel is to remain unused for any appreciable length of time. Its use as a lubricant for mobile artillery is forbidden. Before applying the slushing oil to any surface, the part should be thoroughly cleaned, so as to be free from rust, water, coal oil, lubricant oil, etc., as their presence will cause rusting under the slushing oil. The slushing oil should then be applied in a *thin uniform coat*, since this is ALL that is necessary to give good protection. Except in very cold weather it can be applied by using a paint brush, as when painting; in cold weather it should be applied by stippling—that is, lightly tapping the surface with the end of the sash tool, held with bristles perpendicular to the surface to be covered. It can be applied to the bores of gun by the slush brush issued for the purpose. In cold weather it should be warmed before use for coating the bores of gun. It may be readily removed by the use of burlap or waste dipped in coal oil.

REPAIRS FOR FIELD ARTILLERY MATÉRIEL ISSUED TO THE UNITED STATES ARMY AND THE NATIONAL GUARD.

Instructions relative to making repairs to field batteries and furnishing ordnance stores and supplies for them will be found in the General Orders issued by the War Department from time to time.

Instructions in reference to the care, use, and repair of delicate instruments, such as sights, telescopes, and range finders, will be found in General Orders, No. 47, War Department, Washington, March 24, 1905, and in O. O. pamphlet, Form No. 1795.

INSTRUCTIONS FOR RIVETING.

Whenever a rivet is broken, loose, or needs replacing for any reason the rivets should be heated to a light yellow (just below white) color. They may be heated in the forges furnished with the battery equipment or in a permanent blacksmith's forge. While heating, keep the rivets covered with coals in order to prevent scaling. Rivets one-fourth inch and less in diameter may be driven cold when it is impracticable to heat them. Drive them hot, however, when practicable. Drive all rivets greater than one-fourth inch in diameter hot in all cases. Do not overheat or burn the rivets. Remove all scale from rivets after heating and before driving. Drive the rivets

home with a hammer before attempting to form the head. Hold rivets solidly in place with a sledge, crowbar, and fulcrum, railroad iron or similar heavy piece of steel. Partially form the head with the face and peen end of a hammer. When the head is practically formed by this operation use a rivet set for final forming of the head. The rivet set is only for this final operation. Loose rivets will result if they are not peened down with a hammer before the rivet set is used. The rivets must be held solidly in place while the riveting is being done, otherwise loose rivets results.

Before starting to heat the rivets the pieces to be riveted should be carefully fitted and bolted together. If the holes in the two pieces are not in perfect alignment the cause should be determined and rectified instead of attempting to drift the pieces into alignment. If necessary for perfect alignment a slight amount of reaming or filing will be permitted. In no case should a rivet hole be reamed larger than about one sixty-fourth inch in excess of the diameter of the rivet. On account of inaccessibility it is sometimes difficult to insert a rivet. In such cases it may be inserted with a twisted stiff wire or with a small wooden stick split at the end to hold the rivet. Arrangements must be made beforehand to back up or hold the rivet in place the instant it is located in order that it may not have cooled too much for proper riveting. Hot riveting is preferable to cold riveting, as the head is more easily formed when hot and the contraction of the rivet in cooling gives a tighter fit.

SUGGESTIONS FOR CARE AND MAINTENANCE OF MATÉRIEL.

Various suggestions in reference to the care of this matériel and hints regarding things to be done or to be avoided are scattered throughout the text of this handbook; some of the more important are here condensed for more convenient reference. Careful compliance with these suggestions will avoid delay and possible injury to personnel or matériel.

The breechblock should not be opened for at least one minute after a misfire.

All work upon recoil cylinders, sights, and other optical equipment should be done in the presence of a commissioned officer.

The recoil cylinder should never be clamped in a vise, but when necessary to hold it from turning a spanner applied to front end of cylinder should be used.

Never remove the spring rod nuts when the piece is at an elevation.

See that proper kind of oil is used in cylinders and for lubrication.

Strain the oil used in filling the cylinders through a fine, clean cloth, and be sure that the receptacles used in handling the oil are clean.

Take every precaution to keep the interior of the cylinders clean and to prevent the entrance of foreign particles.

All unpainted surfaces should be kept clean and free from rust, but in no case is a polish required.

In assembling the gland, be sure that at least six threads of the gland are engaged with the threads of the stuffing box.

Lash parts with copper wire to prevent unscrewing.

Before firing, inspect to insure that cylinders are properly closed and that the piston rod and spring rod nuts are in place.

If time permits, oil slides before firing.

If the gun fails to return fully into battery, except when caused by expansion of oil, it is probably due (1) to dirt on slides and guides; (2) to cutting of sliding surfaces on account of dirt and lack of oil; (3) to gland being screwed up too tight; (4) to dirt or foreign particle in the cylinder, and especially in the counter recoil buffer recess; (5) to weakness of springs. Ninety per cent of such cases will be found due to (1), (2), or (3).

To relieve the elevating and traversing mechanisms, the cradle should be locked when traveling. A definite rule can not be given as to when the traveling lock should be used. The object of the traveling lock is to permit the gun to be retracted from its firing position, thereby relieving the carriage axle and wheels of some of the weight and transmitting it to the carriage limber.

In view of the fact, however, that with the gun in this position the weight at the spade is excessive for limbering and unlimbering, the discretion of the battery commander should determine when the gun should be pulled back. For long marches and where the drills would not require unlimbering, the gun should be invariably placed in the traveling position.

The set of large covers now issued should be used whenever the gun is pulled back into the traveling position.

After unlimbering, release elevating and traverse lock before attempting to elevate or traverse gun.

The length of the recoil of the gun during firing should be carefully observed to see that the recoil mechanism is working properly.

For satisfactory action of the recoil controlling parts it is necessary that the cylinder be filled with oil in the exact method previously given and that the parts be kept scrupulously clean.

Close down the ends of the recoil indicator guide to avoid loss of the indicator.

If the elevating screws do not house in traveling, they are incorrectly assembled.

Keep hub bolts and hub bands properly tightened.

To tighten hub bands, screw them as tightly as possible with the wrench and then force them farther by striking the end of the wrench with a hammer.

Tires on wheels should be reset as soon as the wheels have lost their initial dish given by shrinkage. In order to determine when this dish is lost without waiting for the felloe and spokes to actually become loose, the following method should be used:

Place a straightedge across the wheel, resting on the felloe and passing near the hub flange. Measure the distance from the straightedge to a spoke near the felloe and one near the hub box. If the difference in these two distances is less than three-sixteenths of an inch the tire should be reset.

Cold set tires are much inferior to hot set tires in that the dish given by the setting of the tire is lost much more rapidly when cold set. Cold setting should therefore be resorted to only when it is impracticable to have the tires hot set.

Do not permit brake levers to be released by a kick or a blow.

Unnecessary use of tire brakes on rubber tired vehicles should be most carefully avoided, as the rubber tires wear directly against the breaking surface of the brake shoes.

Prevent possible injury to cannoneers by causing them to stand clear of the counter recoil spring column in assembling or dismounting.

In moving the gun on or off the cradle, provide ample support for the breech end, so that the gun clips are in prolongation of the cradle guides; if this is not done, the cradle guides may be ruined.

Do not strike any metal part directly with a hammer; interpose a buffer of wood or copper.

Frequently verify the adjustment of sights.

Require special care in handling sights.

Be sure that the range disk of the quadrant and the range strip of the rear sight shank is graduated for the particular type of ammunition used by the battery.

Do not unnecessarily expose ammunition to the sun or load it into a warm gun before time for firing; if this is done, erratic shooting may result.

Shells should be grouped for firing according to the weights indicated on them. All special shells should be stored apart from other ammunition.

Battery commanders should frequently make a detailed inspection of all of the vehicles in the battery to see if any parts of them are broken and any nuts, screws, split pins, etc., missing. If any such defects are found, he should immediately take steps to replace broken or missing parts. This is of the utmost importance, and compliance with these instructions will do much toward prolonging the life of the vehicles.

It has been found that the apron hinges occasionally become broken, and that the apron-hinge pins are frequently lost. Whenever this happens the hinges or hinge pins should be immediately replaced, for if this is not done the apron, which is a very expensive piece, is apt to become cracked or broken.

Whenever the lunettes become loosened the lunette nuts should at once be tightened up.

All wheels and pintle bearings should be frequently oiled.

All nuts are secured by split pins, which should be replaced and properly opened when nuts are screwed home.

All working and bearing surfaces of the carriage require oiling. Those not directly accessible for this purpose are provided with oil holes closed by spring covers or handy oilers.

Smokeless powder must not be used for blank cartridges.

See that fuzes are set at safety for transport.

Fuze safety pins should never be removed except when ready to serve to the piece.

Fuzes should be screwed home till flange is in contact with the bushing or adapter.

Time fuzes should be protected from damp which may lengthen their time of burning or prevent ignition. Deterioration might

cause flash from detonator pellet to powder pellet, causing premature explosion.

When circumstances permit, lists should be kept up for each gun, of the particulars of the ammunition provided for it, in the order in which it is intended to expend it. Particulars would include: Designation and mark, initial of manufacturer or arsenal, ammunition and lot number. Reference to the list and to the rounds in hand then enables ammunition just fired to be identified and the information is of assistance in tracing causes of failure.

Use the small primer-inserting press for inserting primers in cartridge cases and the decapping tools provided for removing old primers.

In all requisitions and correspondence the correct name of the part referred to (if known) should be given. If the name of the part is not known, submit a sketch showing the location, shape, matériel, etc., sufficient to establish definitely the identity of the parts in question.

The use of the word "complete" in requisitions to signify a combination of parts sometimes leads to misunderstanding of the exact parts wanted. The tables of nomenclature of parts have been arranged to show the parts included under the terms "one trail, complete; one wheel, complete," etc., and should be carefully studied before requisitions are made out, to insure that all the parts wanted are included and duplications avoided. For example, if a piston rod is wanted the order should state whether it is to be with or without the nut. If all details are itemized, it will avoid mistakes and unnecessary expense.

SUPPLIES IN GENERAL.

The supply of ammunition to be kept on hand in a 4.7-inch gun battery will be a sufficient amount to fill all the ammunition chests of the equipment, and in addition a sufficient number of rounds to cover the needs for annual target practice.

Pistol arm racks are issued for use of Field Artillery in such number as may be required to hold the pistols on hand in the battery. Each pistol arm rack holds 80 pistols.

The allowance of electric flashlights for each battery and their apportionment amongst the personnel is as follows:

5 with hoods:

1 for the chief of the fifth section.

4 to equip each gunner.

16 without hoods:

1 for the battery commander.

1 for the reconnaissance officer.

2 to equip each chief of platoon in the firing battery.

4 to equip each chief of gun section.

4 to equip each No. 3 in the gun sections.

4 to equip each No. 1 in the gun sections.

In addition 3 flashlights with hoods are issued to each regimental and battalion headquarters for use with instruments and range finders.

A reloading and cleaning outfit for 4.7-inch guns for removing fired primers from and cleaning cartridge cases and for reloading blank ammunition is furnished to each battery.

EQUIPMENT.

The following table sets forth the total equipment of one 4.7-inch gun battery motorized on war footing. The right-hand column shows in general where each article should be carried, but the battery commander may use his discretion as to the disposition of many articles for which no particular fitting or receptacle is provided.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY MOTORIZED ON WAR FOOTING.

Number.	Article.	Where carried.	Property classification.	
			Class.	Section.
WHEELED MATÉRIEL.				
4	4.7-inch guns, model of 1906.....	.....	
4	4.7-inch gun carriages, model of 1906.....	.....	
4	4.7-inch gun and 6-inch howitzer limbers, model of 1905.....	.....	
12	Caissons, model of 1917 or model of 1916. ¹.....	.....	
MOTOR EQUIPMENT.				
10	Tractors, 5-ton.....	.....	
6	Ammunition trucks.....	.....	
1	Artillery supply truck.....	.....	
1	Telephone and motor battery type truck.....	.....	IV	3
1	Reconnaissance car.....	.....	
8	3-ton, four wheel drive trucks.....	.....	
3	5-passenger motor cars.....	.....	
10	Motorcycles with side cars.....	.....	
1	Reel truck, model of 1918.....	.....	
GUN AND GUN CARRIAGE ACCESSORIES.				
4	Bar screw drivers.....	In trail tool box.....		
4	Breech covers.....	On guns.....		
4	Covers for guns.....	On gun in traveling position.....		

¹ 6 caissons, model of 1908, may be substituted for 6 caissons, model of 1917 or 1916; 6 caisson limbers, model of 1908, may be substituted for 6 caissons. A description of the caisson and caisson limber, model of 1908, is in handbook No. 1771, revised Sept. 15, 1917.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.

Num-ber.	Article.	Where carried.	Property classification.	
			Class.	Sec-tion.
	GUN AND GUN CARRIAGE AC- CESSORIES—continued.			
4	Covers for front sights.....	} On sights.....		
4	Covers for rear sight brackets...			
4	Covers for rear sight shanks.....			
8	Dust guards for 50 inch and 60 inch-wheels.	On wheels.....		
4	Elevating gear covers.....	On elevating gears.....		
8	Hand fuze setters with cases.....	In trail boxes.....		
4	Horizontal oilers, model of 1913.	In oil can boxes.....		
8	Lanyards.....	In trail tool box.....		
4	Leather pouches for spare parts.	do.....		
4	Maneuvering bar.....	On trail.....		
4	Muzzle covers.....	On guns.....		
4	Oil can boxes.....	In trail tool box.....		
4	Spanner wrenches, cylinder head, and stuffing box gland.	do.....		
4	Sponges and rammers, complete.	On trails.....		
4	Sponge and rammer covers.....	On sponges and rammers..		
4	3-pound spools, No. 20 annealed, bare copper wire.			
4	Tool kits, each containing—			
	1 cross peen hammer.....		IV	3
	1 large bronze drift.....			
	1 pliers (wire cutting), 8- inch.			
	1 range quadrant wrench... ..			
	1 right-angle screw driver... ..			
	1 screw slot wrench and blade.			
	1 small bronze drift.....			
	1 small punch.....			
	1 0.75-inch cold chisel, 8- inch.	In trail tool box.....		
	1 6-inch 3-square, dead smooth file.			
	1 8-inch hand smooth file... ..			
	1 10-inch screw driver.....			
4	Wrenches, wheel hub, and pintle yoke.			
4	Wrenches, 0.375 by 0.5.....			
4	Wrenches, 0.625 by 0.875.....			
4	Wrenches, 1.125 inch and 1.5 inch.			
4	Wrenches, 0.75 by 1.....			

**STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.**

Num-ber.	Article.	Where carried.	Property classification.			
			Class.	Section.		
	SPARE PARTS FOR GUNS AND GUN CARRIAGES. (For guns.)					
4	Block latch.....	In leather pouch for spare parts.	IV	3		
4	Block latch spring.....					
4	Extractor.....					
4	Firing pin.....					
4	Firing (pin) spring.....					
4	Firing spring sleeve.....					
4	Handy oiler (clip) (0.312).....					
4	Handy oiler (hinge pin) $\frac{1}{8}$ -inch.....					
1	Handy oiler (jacket) (0.5-inch)..					
4	Hinge pin catch.....					
4	Lever latch spring.....					
4	Loading tray.....					
1	Locking bolt and pin.....					
4	Locking bolt knob.....					
4	Locking bolt spring.....					
4	Plug.....					
1	Sear.....					
4	Tray latch spring.....					
4	Tray latch stop.....					
4	Trigger fork.....					
4	Trigger shaft detent.....					
8	Breech mechanism complete... (For fuze setters.)	In spare breech mechanism chest on artillery supply wagon.				
16	Range-ring screws.....	In leather pouch for spare parts.	IV	3		
4	Stop-pin screws.....					
12	Guide-plate screws.....					
4	Corrector-scale screws.....					
4	Range indices.....	In leather pouches for spare parts.				
4	Index plungers.....					
4	Index springs.....					
4	Oil-hole screws.....					
8	Index-bar screws.....					
	(For carriages.)					
1	Apron latch (complete).....	In supply chest.....			IV	3
2	Apron latch spring.....					
1	Apron latch (body) pin with split pin.					
1	Adjusting bolt eye ¹					
2	Band clip ¹					
2	Band guide ¹					
4	Bolt, 0.5 by 0.75, with lock washer (for band clip). ¹					

¹ For band brake model only.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.

Num-ber.	Article.	Where carried.	Property classification.	
			Class.	Sec-tion.
SPARE PARTS FOR GUNS AND GUN CARRIAGES—continued.				
(For carriages.)				
12	Bolt swing, for cylinder cover with pinion nut. ¹	In supply chest.....	IV	3
1	Brake band with lining, ends and guide, right. ¹			
1	Brake band with lining, ends and guide, left. ¹			
1	Brake crank ¹			
1	Brake lever with cap, assembled ¹			
2	Brake drum ¹			
1	Brake lever hinge ¹			
2	Brake lever spring ¹			
1	Brake segment rack ¹			
2	Brake lever with catch and spring bracket. ²			
2	Brake lever spring ²			
2	Brake rod pins ²			
1	Brake rod spring ²			
1	Brake segment rack with bolts ² .			
4	Brake shoe ²			
2	Brake shoe pins ²			
6	Counter-recoil springs, outer....			
6	Counter-recoil springs, middle....			
6	Counter-recoil springs, inner....			
1	Elevating screw cover with split pin.			
2	Extension rail latch spring.....			
4	Extension rail plunger spring....			
4	Filling and drain plug.....			
1	Firing mechanism complete....			
1	Firing shaft return spring.....			
1	Firing handle return spring....			
20	Garlock waterproof packing 0.375 ring.	5 inches each in leather pouch for spare parts.		
1	Gasket, filling and drain plug...			
4	Handspikes, complete, 2 right, 2 left.			
4	Handy oilers, 0.312 ($\frac{1}{8}$ -inch)....	In supply chest.....		
20	Handy oilers, 0.375.....			
8	Handy oilers, 0.5.....			
2	Hub liners.....			
1	Lock washer.....			
Nuts, crown, special:				
2	1-inch, 8 threads.....	Equally in leather pouches for spare parts.		
2	1.25-inch, 12 threads.....			
Nuts, crown, standard:				
4	0.75.....			
38	0.5.....			
52	0.625.....			

¹ For band brake model only.² For tire brake model only.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.

Number.	Article.	Where carried.	Property classification.	
			Class.	Section.
	SPARE PARTS FOR GUNS AND GUN CARRIAGES—continued.			
	(For carriages.)			
	Nuts, crown, standard—Contd.			
36	0.75.....	Equally in leather pouches for spare parts.	IV	3
6	0.875.....			
2	1.25.....			
2	1.5.....			
2	Nut leveling screw.....			
1	Nut traversing.....			
2	Nuts, special 0.187 ($\frac{3}{16}$ -inch), 26 threads (F. A. standard).			
2	Nuts, 0.19, 30 threads, standard nut plain.			
	Pins, Type A:			
2	0.433 by 2.4 (A=1.95) (top fastening shield).			
1	0.610 by 1.875 (A=1.27) ¹			
1	0.610 by 2.125 (A=1.56) (brake crank) ¹ .			
1	Pin, elevating with split pin....			
2	Pin, extension rail with split pin.			
2	Pin, top shield brake with chain.			
	Pins, split:			
4	0.046 ($\frac{3}{64}$) by 0.312 ($\frac{5}{16}$).....			
4	0.062 ($\frac{1}{16}$) by 0.562 ($\frac{9}{16}$).....			
13	0.093 ($\frac{3}{32}$) by 0.5.....			
5	0.093 ($\frac{3}{32}$) by 0.75.....			
40	0.093 ($\frac{3}{32}$) by 1.0.....			
4	0.125 by 0.75.....			
8	0.125 by 1.....			
60	0.125 by 1.25.....			
20	0.125 by 1.5.....			
10	0.156 ($\frac{5}{32}$) by 1.....			
90	0.156 ($\frac{5}{32}$) by 1.5.....			
20	0.156 ($\frac{5}{32}$) by 1.75.....			
4	0.062 ($\frac{1}{16}$) by 0.275.....			
2	0.203 ($\frac{13}{64}$) by 1.5.....			
3	0.203 ($\frac{13}{64}$) by 2.....			
4	0.203 ($\frac{13}{64}$) by 2.25.....			
2	0.25 by 1.5.....			
2	0.25 by 1.75.....			
2	0.25 by 2.....			
2	0.25 by 2.75.....			
2	0.25 by 3.....			
20	0.25 by 3.5.....			
1	Recoil cylinder lock catch with lock pin and split pin.	On artillery supply truck..		
1	Recoil indicator, complete.....			
	Rivets, steel button-head:			
2 0.01	C. 125 by 0.5.....			

¹ For band brake model only.² Pound.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.

Number.	Article.	Where carried.	Property classification.	
			Class.	Section.
SPARE PARTS FOR GUNS AND GUN CARRIAGES—continued.				
(For carriages.)				
Rivets, steel, button-head—Con.				
1 0.1	0.187 ($\frac{3}{16}$) by 0.5.....	} Carried in supply chest....	IV	3
1 0.1	0.187 ($\frac{3}{16}$) by 1.....			
1 0.05	0.187 ($\frac{3}{16}$) by 1.75.....			
1 0.1	0.25 by 1.....			
1 0.1	0.312 ($\frac{5}{16}$) by 1.....			
1 0.8	0.375 by 1.25.....			
1 0.2	0.375 by 2.5.....			
1 0.25	0.5 by 1.25.....			
1 1.9	0.5 by 2.25.....			
1 1	0.5 by 2.75.....			
1 0.5	0.625 by 2.25.....	} Carried in supply chest....	IV	3
Rivets, steel, countersunk head:				
1 0.5	0.375 by 2.75.....			
1 0.3	0.5 by 2.....			
1 0.6	0.5 by 1.25 (Spade).....			
1 0.25	Rivets, countersunk 90° 0.5 by 1.75.			
1 0.20	Rivets (spade point).....	} On artillery supply truck..		
2 2	Rod, bronze, 0.125 inch diameter			
1	Spade edge.....			
2	Spade point.....			
1	Sponge and rammer complete..			
5	Sponge and rammer cover.....			
1	Spring cover No. 1, complete...			
2	Wheel complete, rubber (61 by 6 inches).			
2	Wheel fastenings, complete.....			
2	Wheel hook.....			
4	Wing nut.....	} Carried in supply chest....		
2	Wing nut.....			
2	Wing nut pin.....			
SPARE PARTS FOR 4.7-INCH AND 6-INCH HOWITZER LIMBER, MODEL OF 1905.				
4	Handy oilers, 0.312 ($\frac{5}{16}$ -inch)....	} In supply chest.....		
2	Hub liners.....			
1	Lock washer (wheel).....			
1	Wheel, 51 by 4 inches (rubber tired).			
1	Wheel, fastening, complete.....	} On artillery supply truck..	IV	3
2	Wheel, hook.....			
1	Wheel oil valve, complete.....			
TOOLS AND ACCESSORIES FOR 4.7-INCH AND 6-INCH HOWITZER LIMBER, MODEL OF 1905.				
1	Cyclometer.....	} On one of the 4 limbers....	IV	9
1	Cyclometer tally pin.....			
8	Dust guard (50-inch and 60-inch wheel).			
	1 Pound.	2 Feet.		

**STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.**

Num-ber.	Article.	Where carried.	Property classification.	
			Class.	Section.
	SPARE PARTS FOR CAISSON, MODEL OF 1917.			
3	Apron hinge, complete.....	In supply chest.....	IV	3
1	Apron latch, complete.....			
1	Axle bracket.....			
1	Bolt, standard, 0.625 by 2.5 (pin- tle bearing).			
24	Bushing, with pins (axle bracket)			
32	Belleville springs.....			
2	Brake band, complete.....			
6	Brake lining.....			
2	Brake drum (Cr., Ca.).....			
2	Brake hanger.....			
2	Brake lever, complete.....			
2	Brake lever bearing.....			
2	Brake lever catch.....			
1	Brake lever hook.....			
2	Brake lever rod, complete.....			
2	Brake rod, complete.....			
4	Brake shaft bearing.....			
2	Brake shaft lever.....			
2	Chain No. 16, complete (Cr., Ca., Cr. L.)			
8	Carrying spring.....			
6	Chest guide, with 0.75 crown nut and split pin.			
4	Connecting pole key with split pin.			
1	Caisson prop, complete.....			
3	Hub liner (Cr., Cr. L., Ca.).....			
3	Lock washers (wheel) (Ca., Cr. L., Ca.).			
2	Lunette.....			
	Nuts, standard plain:			
8	0.5.....			
12	0.75 (forged steel No. 3).....			
4	Nuts, crown 0.75 (forged steel No. 3).....			
2	Padlock No. 850 with clevis and rivet.			
	Pins, split:			
86	0.125 by 0.75 (Cr., Ca.).....			
86	0.156 ($\frac{5}{32}$) by 1 (Cr., Cr. L., Ca.).			
250	0.156 ($\frac{5}{32}$) by 1.25.....			
8	0.25 by 1.75 (Cr., Ca.).....			
14	0.25 by 1.875.....			
30	0.203 by 1.25 (Cr., Ca.).....			
2	0.203 by 1.5 (Cr., Ca.).....			
10	0.25 by 3.5 (Cr., Ca.).....			

NOTE.—Cr.=Carriage, Ca.=Caisson, Cr. L.=Carriage limber.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.

Number.	Article.	Where carried.	Property classification.	
			Class.	Section.
	SPARE PARTS FOR CAISSON, MODEL OF 1917—contd.			
	Pins, steel:			
2	Pin (lunette).....	In supply chest.....	1V	3
6	Pin (lock lever).....			
	Pins, type A:			
4	0.368 by 1.76 ($\Lambda=1.26$).....			
4	0.610 by 1.875 ($\Lambda=281$) ($1\frac{3}{4}$)..			
4	0.734 by 2.5 ($\Lambda=1.656$) ($1\frac{3}{4}$)..			
2	0.610 by 2.375 ($\Lambda=1.531$) ($1\frac{3}{4}$)..			
2	0.610 by 2.25 ($\Lambda=1.406$) ($1\frac{3}{4}$)..			
	Pins, types C.			
2	0.368 by 1.25 ($\Lambda=0.625$) with split pin.			
2	0.368 by 1.375 ($\Lambda=0.687$) ($1\frac{1}{8}$) with split pin.			
	Pins, type D:			
4	0.610 by 3.125 ($\Lambda=1.875$; B=0.625).			
4	0.866 by 3.125 ($\Lambda=2$; B= 0.562) ($1\frac{2}{3}$)..			
4	Pins, pintle latch.....			
1	Pintle bearing complete.....			
1	Pintle latch.....			
2	Pintle latch spring.....			
2	Pintle spring with bolt and nut.			
2	Pole complete (connecting) (Cr. L., Ca.).			
6	Pole pin.....			
14	Rivets (door hinge).....			
1 4	Rivet (copper) for brake lining 0.25 by 0.875.			
4	Screws, steel, 0.75 by 7.125 (fillis- ter head) thread 1.125 long (axle bracket).			
1	Segment rack.....			
4	Spring bolt.....			
4	Spring bolt head.....			
8	Spring bolt head lock.....			
4	Washers, spring bolt.....			
2	Wheel, 61 by 5 inches (steel tire).			
3	Wheel fastening (complete) (Cr., Cr. L., Ca.).			
4	Wing nut pin washer.....			
4	Wing nut (Cr., Ca.).....			
3	Wing nut pin (apron).....			
2	Wing nut pin (door).....			

¹ Pound.

NOTE.—Cr.=Carriage, Cr. L.=Carriage limber, Ca.=Caisson.
Spare parts for different models of caissons in each battery will be in the proportion
of 1908, 1916, and 1917 models in that individual battery.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.

Number.	Article.	Where carried.	Property classification.		
			Class.	Section.	
TOOLS AND ACCESSORIES FOR CAISSON, MODEL OF 1917.					
12	Ax.....	On top of chest.....	IV	9	
12	Cartridge hooks.....	Left side of chest.....			
24	Dust guards (for 50 and 60 inch wheel).	On wheels.....	IV	3	
12	Fuze box (Mark II fuze).....	} On foot rests.....			
12	Fuze box (Mark V fuze).....				
12	Hatchet.....	On left side of chest.....	IV	9	
12	Lantern.....	On rear plate.....			
12	Lantern bracket pad.....	In lantern bracket.....	IV	3	
12	Oil can (approx. 2 gal.).....	Between intermediate plates.			
12	Paulin.....	On top of chest.....			
12	Pickax.....	On rear plate.....			
12	Picket rope.....	On top of caisson.....			
12	Spanner for 60-inch wheel.....	On rear plate.....			
6	Shovel (short handle).....	}do.....			
6	Shovel (long handle).....				
	Straps.	Length.	No. of holes.		
12	Cartridge hook ..	12	7	IV	9
24	Shovel handle...	15.5	7		
12	Pick handle.....	13.5	7		
12	Spanner.....	13.5	7		
36	Grip.....	22.75	5		
36	Paulin.....	42	5		
48	Limber blanket (long).....		10		
24	Limber blanket (short).....	40	10		
24	Fuze box (short)	8	1		
12	Fuze box (long)	8	1		
12	.....do.....	20	5	
12	.....do.....	12.5	5	
12	Lantern, strap.....			
12	Picket rope (short), strap.....			
12	Picket rope (long), strap.....			
12	Wrench, 0.625 and 0.75.....	Between intermediate plates.	IV	3	
24	Water bucket, canvas.....	.....do.....	IV	9
SPARE TOOLS AND ACCESSORIES.					
1	Cartridge hook.....	} On artillery supply truck..	IV	9	
1	Paulin.....				
1	Picket rope.....				

**STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.**

Number.	Article.	Where carried.	Property classification.	
			Class.	Section.
	TOOLS AND ACCESSORIES FOR 4.7-INCH GUN CAISSON, MODEL OF 1908 AND 1916.			
12	Ax.....	On top of chest.....	IV	9
12	Cartridge hook.....	On right side of chest.....		
24	Dust guard for 50 and 60 inch wheels.	On wheels.....	IV	3
12	Hatchet.....	On left side of chest.....	IV	9
12	Lantern.....	On rear of chest.....		
12	Lantern bracket pad.....	On rear of chest in bracket.	IV	3
12	Oil can.....	Between intermediate plates.		
12	Paulin, 12 by 12 inches.....	On top of chest.....	IV	9
12	Picket rope.....	do.....		
12	Pick mattock.....	On left side of chest.....	IV	9
12	Shovel, longhanded.....	On right side of chest.....		
24	Watering bucket, canvas.....	On rear in bucket holder.....	IV	9
216	Straps.....	On lantern bracket.....		
12	Lantern strap.....	On front door.....	IV	9
12	Fuze box.....	On lower intermediate plate.		
12	.....do.....	.....do.....		
	SPARE PARTS FOR CAISSONS, MODELS OF 1908 AND 1916.			
3	Apron hinges, with pin.....	On artillery supply truck.	IV	3
1	Apron latch, complete.....			
2	Apron latch base with washer, split pin.			
2	Apron latch springs.....			
2	Brake levers with catches ¹			
12	Brake shoes ¹			
6	Brake shoe pins ¹			
2	Adjusting bolts ²			
2	Brake band complete ²			
6	Brake band linings ²			
2	Brake drums ²			
2	Brake levers complete ²			
2	Brake lever catches ²			
1	Brake lever hook ²			
2	Brake shaft bearings, left ²			
2	Brake shaft bearings, right ²			
2	Brake shaft levers ²			
1	Caisson prop with chain and hook.			
1	Caisson prop chain (A=31.875) and prop hook.			
1	Cartridge hook.....	.....do.....	IV	9

¹ For tire brake caissons only.² For band brake caissons only.

**STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.**

Number.	Article.	Where carried.	Property classification.	
			Class.	Section.
	SPARE PARTS FOR CAISSONS, MODELS OF 1914 AND 1916—contd.			
2	Hub liners.....	} On artillery supply truck.	IV	3
3	Lock washers.....			
1	Lunette.....			
2	Lunette pins.....			
2	Padlocks, chains, clevises, and bolt snaps.			
1	Pintle with bearing complete...			
2	Pintle bearing bolts, 1 nut strip.			
1	Pintle latch.....			
2	Pintle latch springs.....			
2	Pintle springs with bolts and nuts.			
	Split pins:			
1	0.093 ($\frac{3}{16}$) by 0.5.....			
5	0.093 ($\frac{3}{16}$) by 0.75.....			
9	0.093 ($\frac{3}{16}$) by 0.875.....			
85	0.093 ($\frac{3}{16}$) by 1.....			
5	0.125 by 0.75.....			
9	0.125 by 1.....			
60	0.125 by 1.25.....			
2	0.156 ($\frac{5}{16}$) by 0.75.....			
4	0.156 ($\frac{5}{16}$) by 1.....			
8	0.156 ($\frac{5}{16}$) by 1.25.....			
85	0.156 ($\frac{5}{16}$) by 1.5.....			
2	0.203 ($\frac{13}{16}$) by 1.25.....			
5	0.203 ($\frac{13}{16}$) by 2.....			
2	0.25 by 1.....			
2	0.25 by 1.25.....			
1	0.25 by 1.5.....			
5	0.25 by 2.5.....			
10	0.25 by 3.5.....			
3	Wheels complete, 61-inch rubber-tired.			
3	Wheel fastenings complete.....			
	MISCELLANEOUS SPARE PARTS FOR TOOLS AND ACCESSORIES.			
3	Padlocks with chains, clevises, and bolt snaps.	} ...do.....	IV	9
4	Ax helves.....			
4	Hatchet handles.....			
4	Pickax handles.....			
2	Shovel handles, long.....			
3	Shovel handles, short.....			
	SIGHTS AND QUADRANTS.			
4	Sights, complete.....	In fastening on cradles....	} IV	3
4	Panoramic sights.....	In case on shield.....		
4	Range quadrants.....	In case on right side of trail.		
4	Teat wrenches for panoramic sight.	In case on shield.....		

**STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.**

Number.	Article.	Where carried.	Property classification.	
			Class.	Section.
	SPARE SIGHTS AND QUADRANTS.			
1	Sight, complete.....	} In spare sights chests on artillery supply truck.	} IV	} 3
1	Panoramic sight.....			
1	Range quadrant.....			
1	Teat wrench for panoramic sight			
	RANGE-FINDING AND FIRE-CONTROL EQUIPMENT.			
1	Aiming circle, model of 1916 complete (except case).	} On reel truck, model of 1918	} V	} 1
1	Aiming circle carrying case.....			
1	Aiming circle tripod carrying case.			
2	B. C. periscopes, model of 1918, complete (except case).			
2	B. C. periscope tripod carrying cases.			
2	B. C. periscope carrying cases....			
10	B. C. rulers, wooden.....			
2	B. C. telescopes, model of 1915, complete (except case).			
2	B. C. telescope carrying cases....			
2	B. C. telescope tripod carrying cases.			
5	Flashlights with hood.....			
16	Flashlights without hood.....			
1	Plotting board, model of 1918...			
2	Prismatic compass with tripod.			
2	Prismatic compass carrying case			
2	Prismatic compass tripod carrying case.			
1	Range finder, 1-m. base, model of 1916, complete (except case).			
1	Range finder carrying case.....			
1	Range finder tripod and adjusting bar carrying case.			
1	Reel (on caisson), model of 1917..			
2	Semicircular protractors.....			
1	Slide rule, model of 1917.....			
1	Steel tape (30 m.).....			
1	Straightedge, 24-inch, model of 1917.			
	MISCELLANEOUS EQUIPMENT.			
1	Reloading and cleaning outfit, consisting of—	} On artillery supply truck..	} IV	} 9
	1 case holder.....			
	1 case holder stand.....			
	1 cleaning brush.....			
	1 decapping tool.....			
	1 hammer.....			
	1 powder measure (saluting).			
	1 press for inserting primer..			
	1 bushing.....			

**STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.**

Number.	Article.	Where carried.	Property classification.	
			Class.	Section.
	MISCELLANEOUS EQUIPMENT— continued.			
8	Drill cartridges with the following spare parts—			
	16 rotating pins.....	} Not carried in field.....	IV	9
	16 stop pins.....			
	1 graduating ring with felt washer.			
	4 locking screws.....			
	2 point nut screws.....			
1	Pistol cleaning kit.....	Where convenient.....	X	9
2	Arm racks for automatic pistols. (For targets, see O. O. Pamphlet No. 1994.)	Not carried in field.....	X	1
	PERSONAL EQUIPMENT.			
	The equipment of the enlisted men of field artillery motorized batteries will be as follows for each enlisted man:			
1	Can, bacon, model of 1910...	} Carried by man.....	IX	1
1	Can, condiment, model of 1910.			
1	Canteen, model of 1910.....			
1	Canteen cover dismounted, model of 1910.			
21	Cartridges, ball, pistol, or 20 cartridges, ball, revolver.	.....do.....	VII	2
1	Cup, model of 1910.....	} ..do.....	IX	1
1	Fork, model of 1910.....			
1	Haversack, model of 1910....			
1	Knife, model of 1910.....	.....do.....	VII	2
2	Magazines, pistol, extra.....	.....do.....	IX	1
1	Meat can, model of 1910.....	.....do.....	VII	2
1	Pistol or revolver.....	.....do.....	IX	3
1	Pistol belt without saber ring.	.....do.....	IX	3
1	Pistol holster, model of 1911.	.....do.....	IX	1
1	Spoon, model of 1910.....	.....do.....	IX	1
1	Pouch for first-aid packet, model of 1910.	.....do.....	IX	1
1	First-aid packet (Medical Department) furnished by Quartermaster Corps:			
1	Identification tag.....	} ..do.....	IX	1
1	Shelter tent, half.....			
1	Shelter tent, pole.....			
5	Shelter tent, pegs.....			

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.

Num-ber.	Article.	Where carried.	Property classification.	
			Class.	Sec-tion.
	ARTICLES CARRIED ON ARTIL- LERY SUPPLY TRUCK.			
1	Chest, spring.....			
1	Chest, supply (containing spare parts for guns, gun carriages, caissons, and limbers).		IV	3
1	Chest, supply.....		IV	3
20	Bolo.....		VII	5
20	Scabbards, Bolo.....			
¹ 1	Brush, varnish, No. 4-0.....			
¹ 2	Brush, varnish, No. 5-0.....			
25	Cable, high tension, Packard SAE ignition, feet.			
¹ 1	Leather, bridle, back.....			
¹ 1	Leather, collar, back.....			
¹ 1	Leather, Latigo, side.....			
¹ 1	Leather, harness, back.....			
1	Magneto, Eisemann G-4 second edition, complete with impulse starter, clockwise rotation for Nash trucks; counter clockwise rotation for F. W. D. truck.			
6	Pliers, wire cutting, 8-inch..			
24	Plugs, spark, $\frac{7}{8}$ -inch, SAE standard "Titan."			
¹ 4	Tape, friction, rolls.....			
¹ 4	Tape, rubber, roll.....			
¹ 1	Wire, copper, No. 16 gauge (B. & S. spool).			
¹ 1	Wire, soft steel, No. 16 gauge (B. & S. spool).			
1	Chest, fluid "A".....	Carried on top of supply chests.	X	10
¹ 2	Brush, varnish, No. 6-0.....			
¹ 3	Brush, for camouflage, 4- inch.			
20	Cans, 2 $\frac{1}{2}$ -gallon capacity (6 will contain lubricating oil; 6 will contain recoil cylinder oil; 2 will contain camouflage paint, green; 2 will contain camouflage paint, brown; 2 will con- tain camouflage paint, gray; 2 will contain coal oil).			
¹ 5	Oil, coal, gallon.....			
¹ 15	Oil, recoil cylinder, gallon..			
15	Oil, lubricating, gallon.....			
1	Paste, stencil, black, box...			
1	Paste, stencil, white, box...			
¹ 5	Paint for camouflage, green, gallon.			
¹ 5	Paint for camouflage, brown, gallon.			
¹ 5	Paint for camouflage, grey, gallon.			

¹ Expendable, quantities are for a six months' supply.

**STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.**

Num-ber.	Article.	Where carried.	Property classification.	
			Class.	Sec-tion.
	ARTICLES CARRIED ON ARTIL- LERY SUPPLY TRUCK—contd.			
4	Strap, 34 inches long, style DV, 8 holes.	Carried in bench chest.....	X	9
8	Strap, 52 inches long, style DV, 10 holes (the above straps are for use on the spring chest, the fluid chest, and the two sup- ply chests).			
1	Chest, grindstone:			
1	Grindstone, with frame, complete.			
1	Wrench, grindstone spanner			
1	Chest, carpenter's, with tools, complete:			
	1 carpenter's chest.....			
	1 ax, bench.....			
	2 bags, canvas, for small stores.			
	1 bevel, 8-inch.....			
	6 bits, auger, sizes 0.25, 0.5, 0.75, 1, 1.25, and 1.5 inch.			
	1 bit, expansive, 2 cutters, 0.875 to 3-inch.			
	3 bits, screw-driver, sizes 0.375, 0.625, and 0.75 inch.			
	1 bit, wood countersink, 0.625-inch diameter.			
	1 brace, ratchet, 10-inch sweep.			
	3 chisels, socket, framing, sizes 0.75, 1, and 1.5 inch.			
	1 divider, wing, 10-inch.....			
	4 drills, twist, sizes 0.187 ($\frac{3}{16}$), 0.218 ($\frac{7}{32}$), 0.25, and 0.281 ($\frac{9}{32}$).			
	1 file, 10-inch, flat, bastard..			
	6 files, saw, sizes 4 and 6 inch.			
	1 gauge, marking.....			
	2 gauges, socket, firmer, sizes 0.5 and 1.			
	1 hammer, claw.....			
	2 handles, file.....			
	1 tool, handle, containing 10 tools.			
	1 knife, drawing, 9-inch blade.			
	1 mallet.....			
	1 nail set.....			
	1 oiler.....			
	1 stone, oil, unmounted.....			
	1 pincers, small, 6-inch.....			
	1 plane, jack, 16-inch.....			

**STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.**

Num-ber.	Article.	Where carried.	Property classification.	
			Class.	Sec-tion.
	ARTICLES CARRIED ON ARTIL- LERY SUPPLY TRUCK—contd.			
	Chest, carpenters, with tools, complete—Continued.			
	1 plane, smoothing, 8-inch..	} Carried in bench chest....	X	9
	1 handle, plate, auger.....			
	1 rasp, wood, 10-inch.....			
	1 reamer, half-round.....			
	1 rule, boxwood, 2-foot, 4- fold.			
	1 saw, crosscut, 24-inch, 7- point.			
	1 saw, rip, 24-inch, 5-point..			
	1 set, saw.....			
	1 screw driver, 5-inch blade.			
	1 spoke shave.....			
	1 square, steel.....			
	1 tape, linen, 100 feet.....			
	1 vise, table, 2.5-inch jaw..			
	1 wrench, screw (12 inches).			
1	Chest for cleaning material and small stores:			
¹ 3	Brush, sash, No. 3.....	}do.....	X	10
¹ 3	Brush, sash, No. 5.....			
¹ 1	Brush, camel's hair.....			
¹ 2	Burners, lantern.....			
¹ 2	Chamois skin.....			
¹ 1	Cloth, crocus, quire.....			
¹ 1	Cloth, emery, No. 0, quire..			
¹ 1	Cloth, emery, No. 00, quire.			
¹ 1	Cloth, emery, No. ½, quire..			
¹ 2	Globes, lantern.....			
¹ 3	Dressing, leather, russet, boxes.			
1	Outfit, marking, leather....	}do.....	X	5
1	Outfit, marking, metal....			
¹ 1	Oil, clock, ounce.....			
¹ 1	Oil, raw linseed, pint.....			
¹ 5½	Petrolatum (in tin box), ounces.			
¹ 20	Sal soda, pounds.....			
1	Seal stamp (in stencil box)..			
1	Outfit, stencil.....		X	10
1	Plate, stencil, Ordnance Department insignia.			
¹ 1	Sandpaper, No. 00, quire...			
¹ 1	Sandpaper, No. 2½, quire...			
¹ 5	Wicks, lantern.....			
1	Chest, miscellaneous.....	Carried in bench chest.....	} IV	3
1	Box, oil.....	Carried in miscellaneous chest.		
1	Chest, for testing level.....	.....do.....	} IV	9
1	Level, testing complete.....	Carried in testing level chest.		

¹ Expendable, quantities are for a six months' supply

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.

Num-ber.	Article.	Where carried.	Property classification.				
			Class.	Sec-tion.			
	ARTICLES CARRIED ON ARTIL- LERY SUPPLY TRUCK—contd.						
5	Cans, 1-gallon capacity, em- bossed, light slushing oil.	}	X	10			
6	Cans, ½-gallon capacity (1 will contain sperm oil, 1 will contain neat's-foot oil, 1 will contain olive drab paint, second coat; 1 will contain olive drab paint, third coat; 1 will contain Japan drier, 1 will contain Cosmic No. 80, soft).						
1	Cosmic, Japan, gallon.						
1	Oil, neat's-foot, gallon.						
1 5	Oil, light slushing, gallon. ...						
1	Oil, sperm, gallon.						
1	Paint, olive drab, second coat, gallon.						
1 1	Paint, olive drab, third coat, gallon.						
1	Tool kit, saddler's, sheepskin, with tools complete:				In saddler's tool kit.	X	9
	1 saddler's sheepskin tool kit.						
	12 blades, awl, harness, Nos. 43 to 48, inclusive.						
	1 awl, pegging.						
	1 awl, seat, handled.						
	1 bag, canvas, for small stores.						
	1 carriage, pricking, 3 wheels.						
	1 compass, 6-inch.						
	1 greaser, double, lignum vitæ.						
	1 tool, edge, No. 1.						
	1 tool, edge, No. 2.						
	2 blades, extra with follow- ers for draw gauge.						
	1 gauge, draw, brass, with- out guard.						
	1 hammer, No. 3, riveting. ...						
	1 handle, peg awl, with wrench.						
	2 hafts, patent awl, with wrench.						
	1 knife, round.						
	1 knife, splitting, 6-inch.						
	1 needlecase, leather.						
	1 needle, glover's, No. 3, paper.						

¹ Expendable, quantities are for a six months' supply.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.

Num- ber.	Article.	Where carried.	Property classification.	
			Class.	Sec- tion.
	ARTICLES CARRIED ON ARTIL- LERY SUPPLY TRUCK—contd.			
1	Tool kit, saddler's, sheepskin, with tools complete—Contd.	In saddler's tool kit.....	X	9
	2 needles, harness, No. 4, paper.			
	2 needles, harness, No. 5, paper.			
	2 needles, harness, No. 6, paper.			
	12 needles, sacking, as- sorted.			
	1 nipper, cutting, 10-inch...			
	1 oilstone, unmounted.....			
	1 pliers, 6-inch.....			
	4 punches, round, assorted..			
	1 punch, revolving, 4 tubes.			
	1 rivet set.....			
	1 rule, boxwood, 2-foot, 4- fold.			
	1 palm, sewing, leather.....			
	1 slicker, steel.....			
	1 shears, 10-inch, bent trimmers.			
	1 knife, shoe, broad point...			
	1 knife, shoe, square point..			
	1 clamp, stitching.....			
	1 screw driver, 3-inch blade.			
	1 tool, claw.....			
	2 thimbles, best aluminum lined, two sizes.			
4	Handles, ax.....				Carried in floor locker.....	IV	9
4	Handles, hatchet.....			
4	Handles, pick ax.....			
3	Handles, shovel, short.....do.....	X	10
2	Handles, sledge, model of 1913..			
¹ 20	Sponges, 4-inch.....	Carried where most con- venient.	IV	9
¹ 25	Waste, white cotton, pounds...			
2	Crowbar, 60-inch.....do.....	X	10
¹ 1	Rope, manila, 1 inch diameter, 150 feet long.			
¹ 1	Rivets and burrs, brass 0.5-inch, No. 10, pound.do.....	X	10
¹ 1	Rivets and burrs, brass 0.625- inch, No. 10, pound.			
2	Handles, shovel long.....do.....	IV	9
¹ 6	Blades, awl, harness assorted, No. 43-48, inclusive. (New England Awl & Needle Co.)do.....	X	9
¹ 1	Hafts, awl patent, with wrench, C. S. Osborne Co., No. 146.			

¹ Expendable, quantities are for a six months' supply.

**STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY,
MOTORIZED ON WAR FOOTING—Continued.**

Number.	Article.	Where carried.	Property classification.				
			Class.	Section.			
	ARTICLES CARRIED ON ARTIL- LERY SUPPLY TRUCK—contd.						
1 10	Buckles, bar, tongueless, $\frac{5}{8}$ - inch, bronze.	Carried where most ex- pedient.	X	10			
1 15	Buckles, bar tongueless, 1-inch, bronze.						
1 10	Buckles, roller bar, $\frac{5}{8}$ -inch, bronze.						
1 50	Buckles, roller, 1 $\frac{1}{4}$ -inch, bronze..						
1 50	Buckles, satchel, $\frac{3}{8}$ -inch, bronze..						
1 25	Buckles, wire, $\frac{3}{4}$ -inch, brass wire.						
1 10	Button, style 1, with washer....						
1 23	Duck, cotton, olive drab, 22- inch, No. 1, yards.						
1 25	Clip, end, $\frac{5}{8}$ -inch, brass.....						
1 5	Clip, end, 1-inch, brass.....						
1 25	Clip, end, 1 $\frac{1}{2}$ -inch, brass.....						
1 10	Fastening, Carr durable female, 4 male.			do.....		
1 2	Hook, side strap, wheel.....			do.....	IV	8
1 10	Fastening mills military.....			do.....		
1 1	Needles, Glover's No. 3, papers..			do.....	X	9
1 1	Needles, harness, No. 4, papers..						
1 1	Needles, harness, No. 5, papers..						
1 1	Needles, harness, No. 6, papers..						
1 100	Rope, $\frac{3}{8}$ -inch, manila hemp, feet.do.....	IV	8			
1 2	Screws, wood, 1 brass, No. 6, 1- gross packages.do.....	X	10			
1 2	Sheepskins with wool on.....						
1 1	Tacks, copper, No. 12 $\frac{1}{2}$, pounds paper.						
1 1	Tacks, copper, No. 20 $\frac{1}{2}$, pounds paper.						
1 1	Thimble, aluminum lined steel, size $\frac{3}{4}$ -inch.						
1 1	Thread, carpet, No. 18, olive drab, pound.						
1 1	Thread, shoe, No. 3, brown, pound.						
1 1	Thread, shoe, No. 10, brown, pound.						
1 1	Wax, stitching brown, winter, pound.						
1 20	Webbing, olive drab, cotton, heavy, $\frac{5}{8}$ -inch, yard.						
1 30	Webbing, olive drab, cotton, heavy, 1-inch, yard.						
1	Sledge, model of 1913.....			do.....	IV	9
1	Block, snatch, for 1.25-inch rope.			do.....	X	10
1 12	Soap, castile, cakes.....			do.....	IV	9
1	Block, tackle, double, 8-inch....			do.....		
2	Bucket, water, galvanized steel.do.....					

¹ Expendable, quantities are for a six months' supply.

**STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY
MOTORIZED ON WAR FOOTING—Continued.**

Num-ber.	Article.	Where carried.	Property classification.	
			Class.	Sec-tion.
	ARTICLES CARRIED ON ARTIL-LERY SUPPLY TRUCK—contd.			
	Additional tools and accessories carried only when truck is supplying a 4.7-inch gun battery:			
1	Bolt.....	} Carried where most ex-pedient.	IV	3
1	Muzzle, bore sight, complete			
1	Breech, bore sight.....			
1	Chain sling.....			
1	Chest for spare breech mechanism.			
1	Chest for spare sights.....			
1	Chest for duplex chain block.			
1	Track, cleaning.....			
1	Clip.....			
1	Block, duplex chain, Yale & Towne, 2-ton.....				.....do.....	IV	9
2	Funnels, filling, cylinder.....	}do.....	IV	3
1	Tool, hub liner driving.....			
2	Jacks, lever.....do.....	IV	9
3	Eyes, retracting.....	}do.....	IV	3
2	Compressors, spring, No. 4..			
3	Covers, spare hub.....			
1	Brush, slush.....			
2	Caps, spare staff coupling...			

AMMUNITION.

The proportion of 45-pound shell and 60-pound shell shrapnel carried is subject to regulation by the proper authority. The ammunition is carried in the caissons and ammunition trucks. The property classification is class VI, section 3.

No. to battery.	Capacity of each.	For shrapnel.	For 45-pound shell.	For 60-pound shell.
12 caisson.....	Caisson.....	23	23	23
6 ammunition trucks ¹ ..	3-ton ammunition truck...	70	81	70
	2-ton ammunition truck...	43	53	46

¹ May be either 2 or 3 ton, in any proportion to total six.

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